SP-70(63)

SPECIAL PUBLICATION

REPORT OF THE ARCTIC ICE OBSERVING AND FORECASTING PROGRAM—1963

Forecasting Branch
Oceanographic Prediction Division

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ABSTRACT

The ice program conducted by the Oceanographic Office principally in support of 1963 MSTS Arctic Operations is covered by this report. Methods of collection and dissemination of ice data, ice forecasting, forecast verification, and various allied ice projects are discussed. A summary of ice conditions in the North American Arctic is given graphically for 6-day periods from January through December.

FOREWORD

This publication is the twelfth in a series of annual reports on ice observing and forecasting programs conducted by the Oceanographic Office. These programs, in addition to providing direct support to resupply operations conducted by the Military Sea Transportation Service, have provided a comprehensive collection of ice information.

This historical information, accumulated primarily by aerial reconnaissance, has not only been extremely valuable in preparation of ice forecasts but is necessary to the overall efficient planning and successful execution of Arctic operations.

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Commander
U.S. Naval Oceanographic Office

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PART I - EASTERN ARCTIC

1. General

The ice forecasting and observing program, designed to support Military Sea Transportation Service (MSTS) resupply operations in the Eastern Arctic during 1963, was conducted by the U.S. Naval Oceanographic Office (NAVOCEANO). The major geographic areas and forecast sectors into which the North American Arctic has been divided for purposes of this study are shown in figure 1. As in past years, MSTS, the Canadian Department of Transport (DOT), and commercial shipping companies conducted resupply operations in the eastern, central, and western areas (figure 1), respectively. Place names referred to in the text are presented in figure 2.

2. Ice Forecasting

The various phases of the overall ice forecasting program in support of MSTS Eastern Arctic resupply operations were coordinated by NAVOCEANO.

a. Long-Range Ice Outlook

The Long-Range Ice Outlook, Eastern Arctic, published during April 1963, was designed to give MSTS a general picture of expected ice conditions during the resupply season. In addition to being distributed to all cognizant commands, the Long-Range Outlook was presented at formal briefings to COMSTS and COMSTSLANTAREA. Forecasts of ice disintegration and opening dates were based on climatic and oceanographic factors affecting ice conditions during the previous fall and winter, a study of similar historical data along with a comprehensive aerial survey of ice conditions from 15 to 25 March, and the latest 30-day weather forecast issued by the U.S. Weather Bureau. Opening dates were determined by estimating times when ice concentrations would permit ships to enter various ports with and without icebreaker escort. Historical freezeup dates and iceberg information were also included in the Outlook.

b. Thirty-Day Ice Forecasts

These long-range forecasts, issued from NAVOCEANO, began on 20 May and continued until 20 November. These forecasts were revisions of the Long-Range Outlook based on aerial ice reconnaissance, historical ice information, and the Weather Bureau 30-day outlooks. Forecasts made later in the season contained freezeup information.

c. Short-Range Ice Forecasts

The 5-day forecasts from NAVOCEANO began on 28 May. From 10 June until 25 July, 48-hour and 5-day forecasts were prepared at the NAVOCEANO ice forecast facility in Argentia. The 48-hour forecasts were issued daily by radioteletype, and the 5-day forecasts were issued three times a week

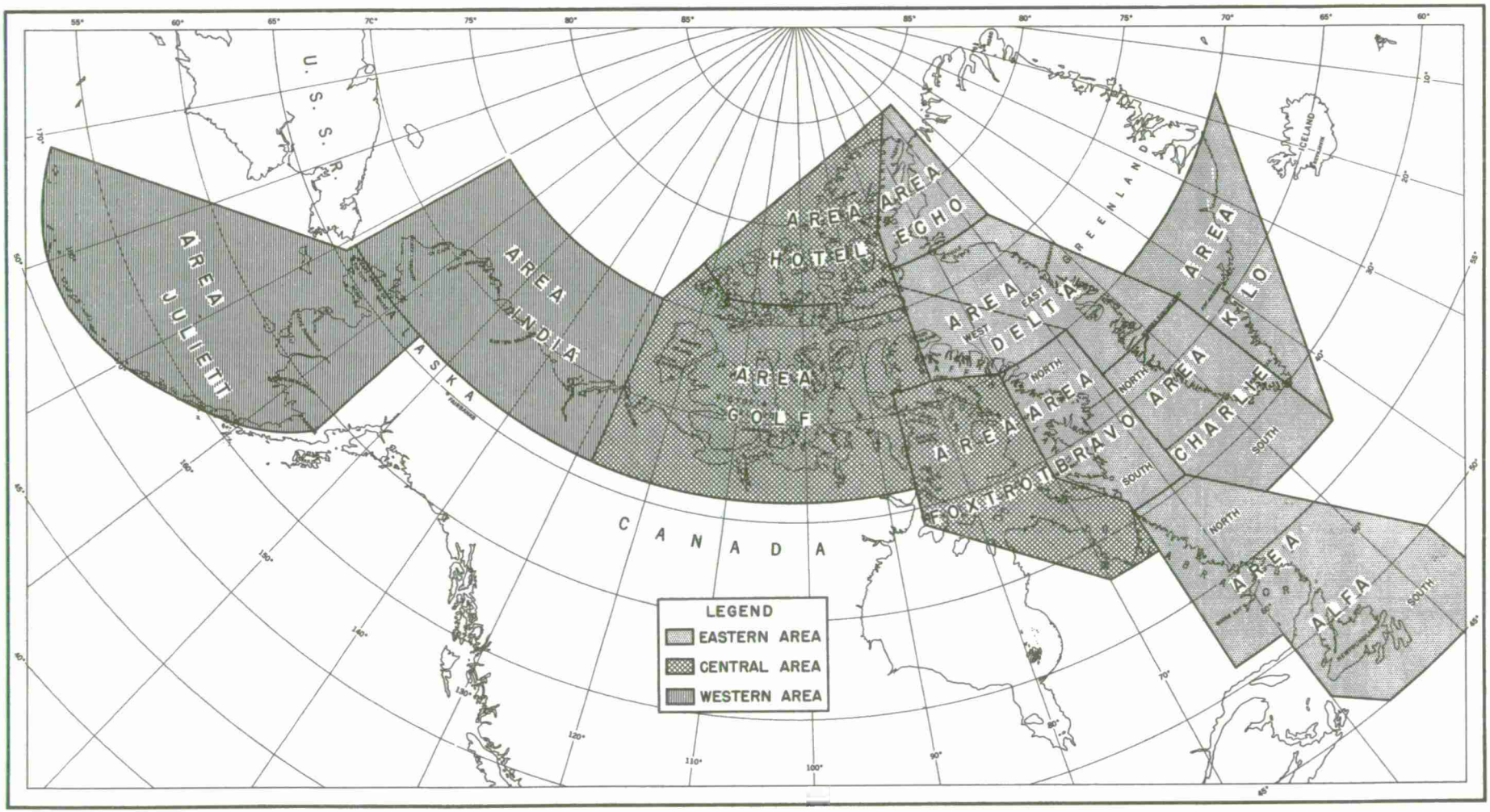


FIGURE I ICE FORECAST SECTORS

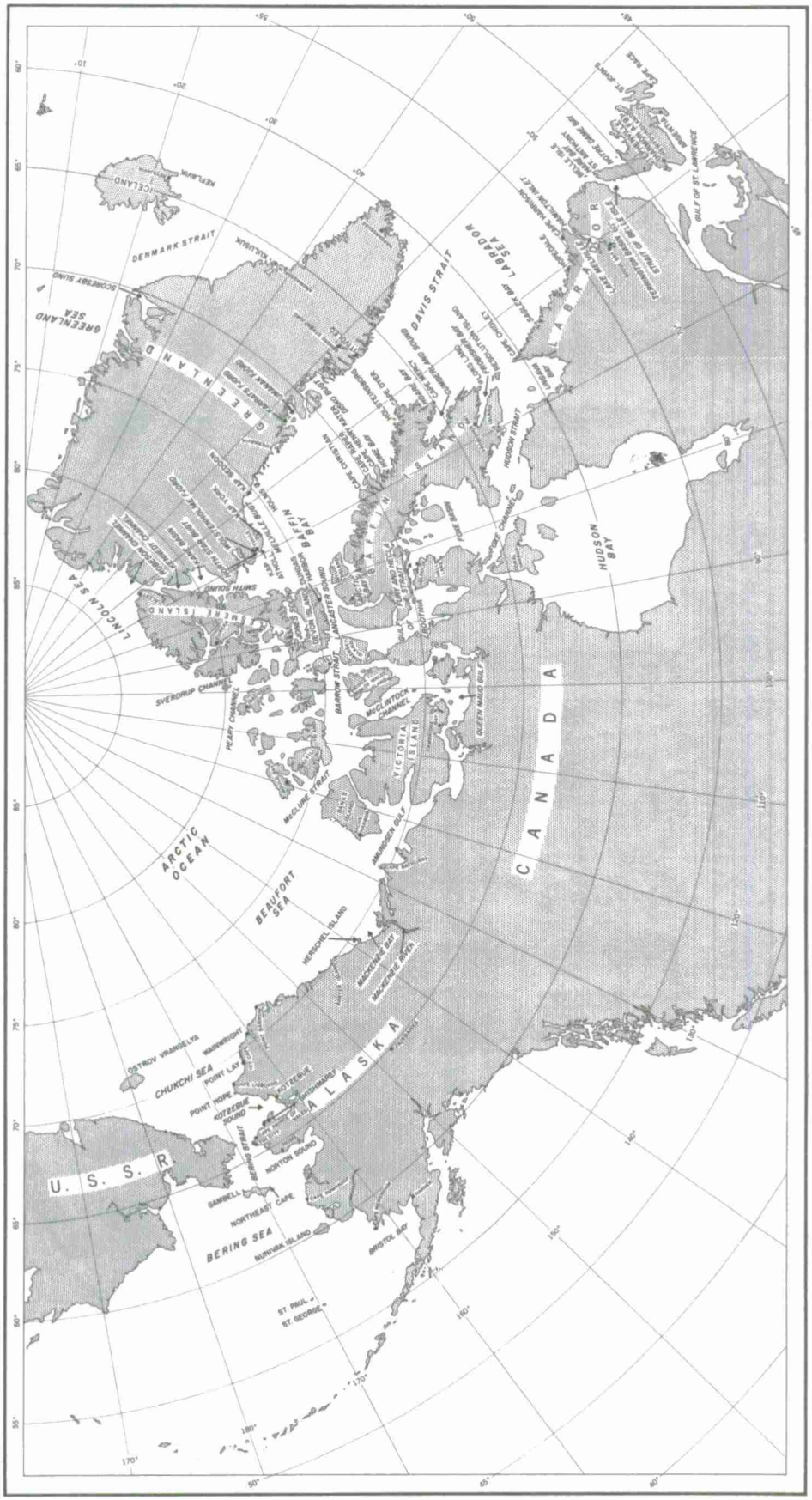


FIGURE 2 PLACE NAME CHART

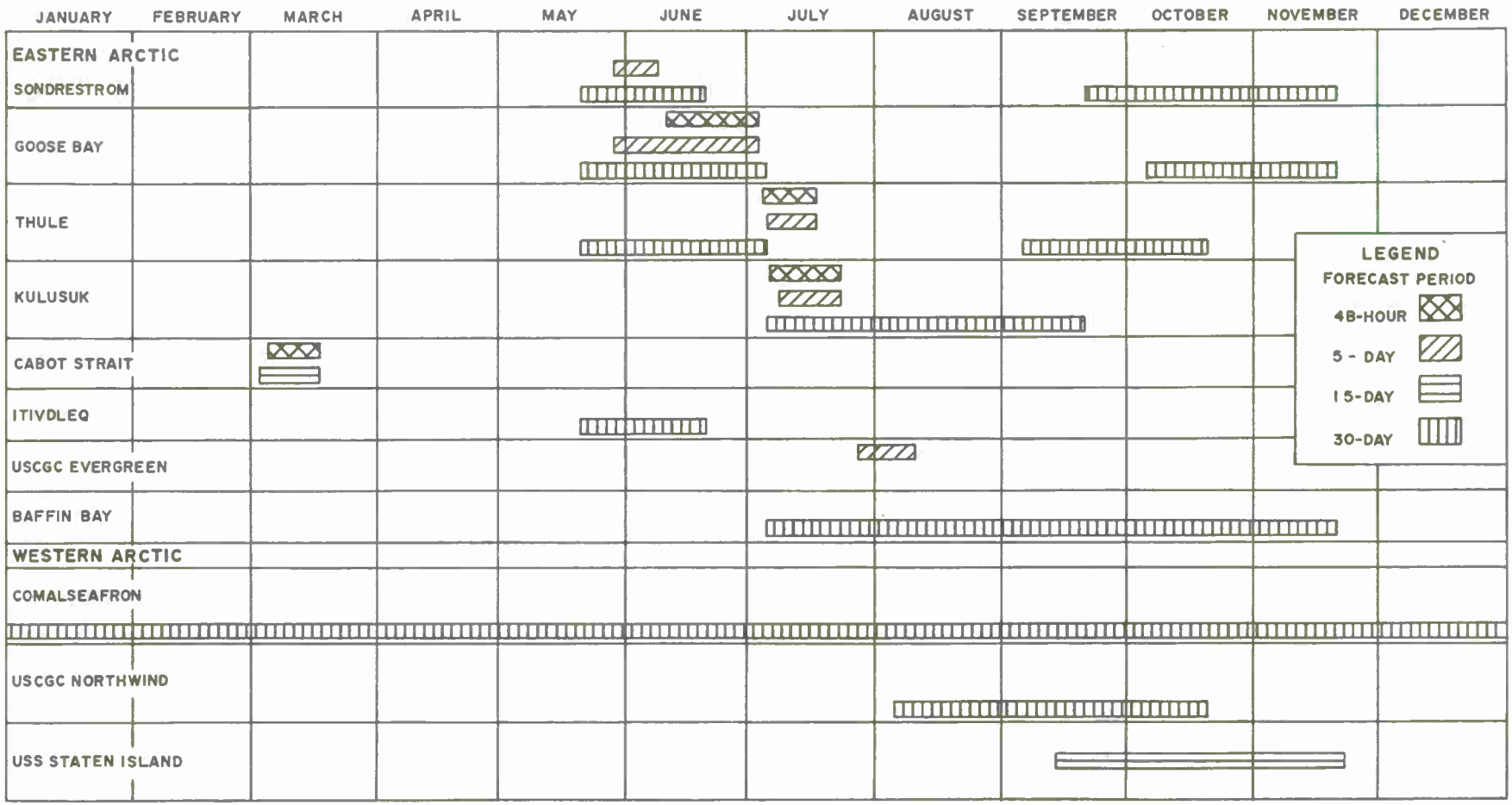


FIGURE 3 SUMMARY OF ICE FORECASTS FOR EASTERN AND WESTERN ARCTIC—1963

as 3-day outlooks appended to the daily forecasts.

Charts of observed and 48-hour prognostic ice conditions were transmitted by radio facsimile. These charts provided tactical support to ships engaged in resupply operations and presented areas of optimum ice navigation. Ice forecasts for both the eastern and western Arctic are summarized in figure 3.

d. Ship Ice Routes

As in previous years, ship ice routing service was provided from NAVOCEANO and the field station in Argentia. Routings were prepared for ships from the continental United States (CONUS) to Arctic ports and return and for intra-Arctic operations. Within the Arctic, routes terminated where icebreaker escort was provided.

Routes above 45°N included areas of significant sea ice and iceberg concentrations, whereas routes south of 45°N were primarily affected by weather.

The ice forecaster monitored all routed ships and recommended necessary route changes. The ships in turn transmitted daily situation reports (SITREPS) to the ice forecast facility.

From 6 May to 13 November, NAVOCEANO and Argentia issued a total of 114 ship ice routes.

e. Special Briefings

At various times during the operation of the Argentia Ice Forecast Facility, special briefings on Arctic ice conditions were given to personnel of the Argentia Coast Guard Air Detachment, to the Commanding Officer of the USCGC EVERGREEN, and to the Naval Weather Service.

3. Ice Reconnaissance

Aerial ice reconnaissance during the 1963 resupply season was provided primarily by SP2E aircraft patrol squadrons stationed at Argentia and Keflavik. These aircraft conducted long-range ice reconnaissance of the eastern Arctic.

Immediate tactical support was provided by icebreaker-based helicopters which made local ice observations. Ice reconnaissance on initial and terminal legs of BIRDS EYE flights supplemented the ice data gathered on SP2E flights.

Figure 4 shows the numbers of hours flown and numbers of flights made over each eastern sector during each month of 1963 as well as the monthly and annual totals. Figure 4 includes data gathered by the U.S. Coast Guard flights as well as those portions of the Canadian reconnaissance flown over the U.S. operational areas. Not included in figure 4 is a large portion

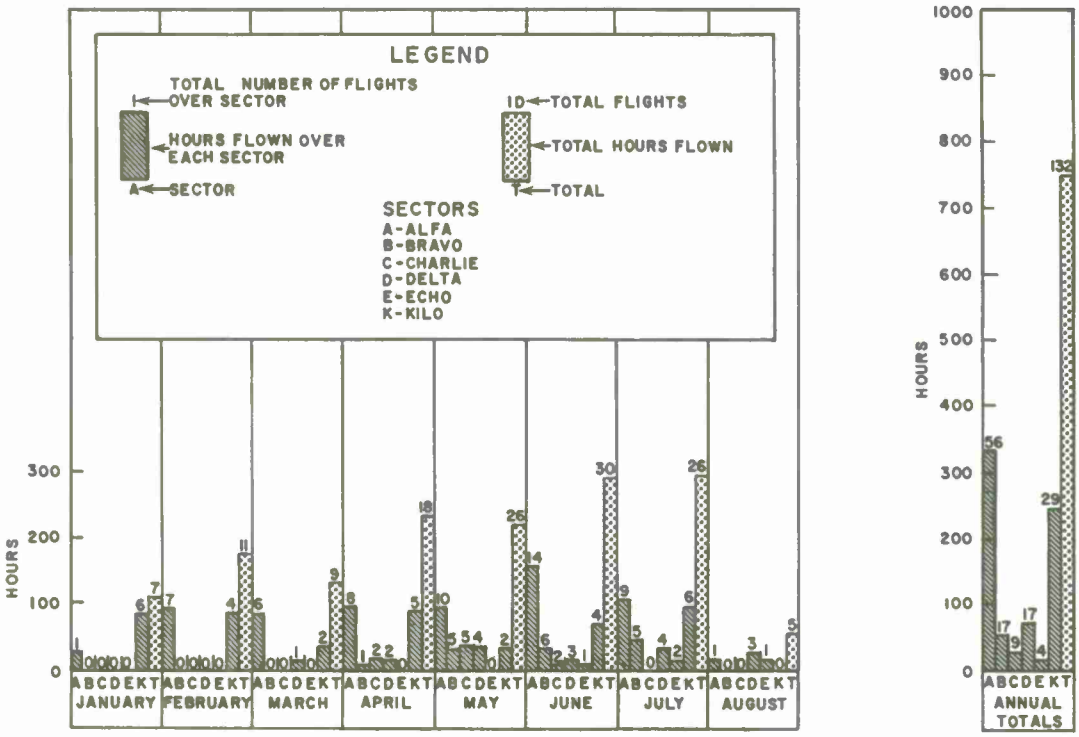


FIGURE 4 SUMMARY OF 1963 AERIAL ICE RECONNAISSANCE, EASTERN ARCTIC

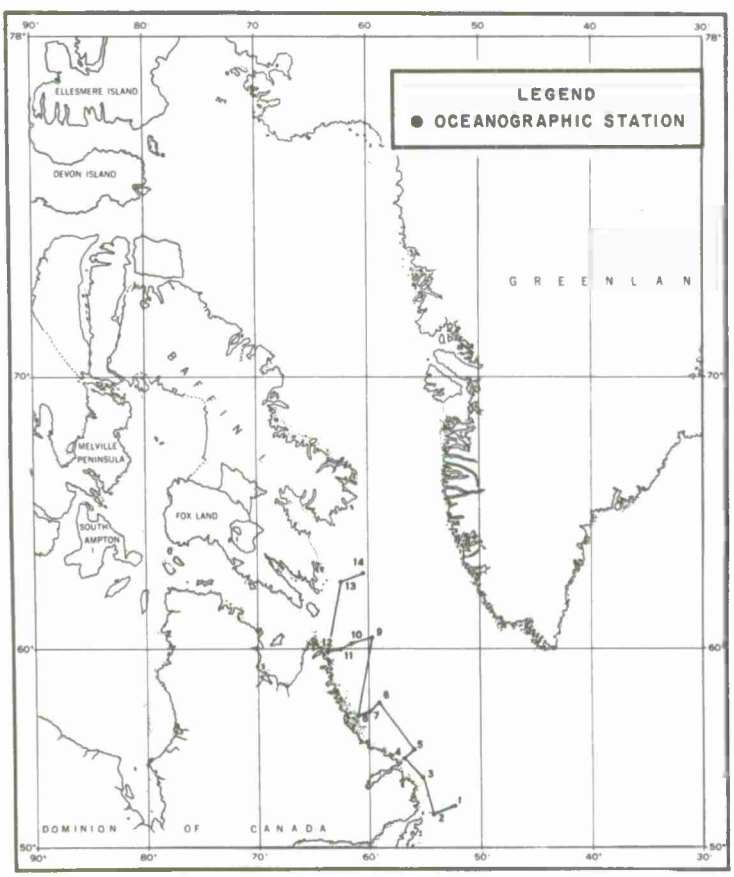


FIGURE 5 OCEANOGRAPHIC STATIONS TAKEN BY USS ATKA (AGB-3), EASTERN ARCTIC, MAY-JUNE 1963

of the reconnaissance over sector KILO that was conducted by Danish flights. Although Danish flights were not specifically scheduled for MSTS support, they yielded much useful data.

4. Communications

In addition to the MSTS leased voice and facsimile Arctic network, the communications system also included Navy and Air Force facsimile and radioteletype facilities.

Facsimile ice charts were transmitted from the ice forecast facility to ships and intra-Arctic ports via Goose Bay and Frobisher Bay radio, whereas word messages were transmitted to CONUS and ships by the Navy Communications Center at Argentia.

Ships experienced some difficulty in receiving good facsimile charts both from Goose Bay and Frobisher Bay.

5. Supporting Projects

a. Oceanography

During May and June the USS ATKA occupied 14 oceanographic stations in the Labrador Sea before severe hull damage forced her to retire. The USS EDISTO occupied 103 stations in the Norwegian Sea during July and August. The Canadian icebreaker LABRADOR occupied 131 oceanographic stations in Baffin Bay, Davis Strait, and the Labrador Sea during September and October. These data were used to compute initial ice formation dates and ice thickness estimates for the 1964 Long-Range Outlook. Stations occupied by United States and Canadian ships are presented in figures 5 through 7.

b. SUBICEX 1-63

From 4 to 17 March, NAVOCEANO provided forecasting support to COMSUBDIV 102 which was operating in the vicinity of Cabot Strait. In addition to a 15-day outlook, seven 48-hour forecasts were prepared for this exercise.

c. USCGC EVERGREEN

Ice forecasting support was provided for the EVERGREEN'S survey of the Ward Hunt Ice Island in Kennedy Channel. From 27 July until 10 August, four 5-day forecasts were prepared at NAVOCEANO for the EVERGREEN. The ice island was located at 80°55'N,67°W on 12 July. The island became dislodged and broke up on 24 July.

d. Project BIRDS EYE

As part of the continuing program of data collection for research and development of ice forecasting techniques, eight BIRDS EYE flights covering

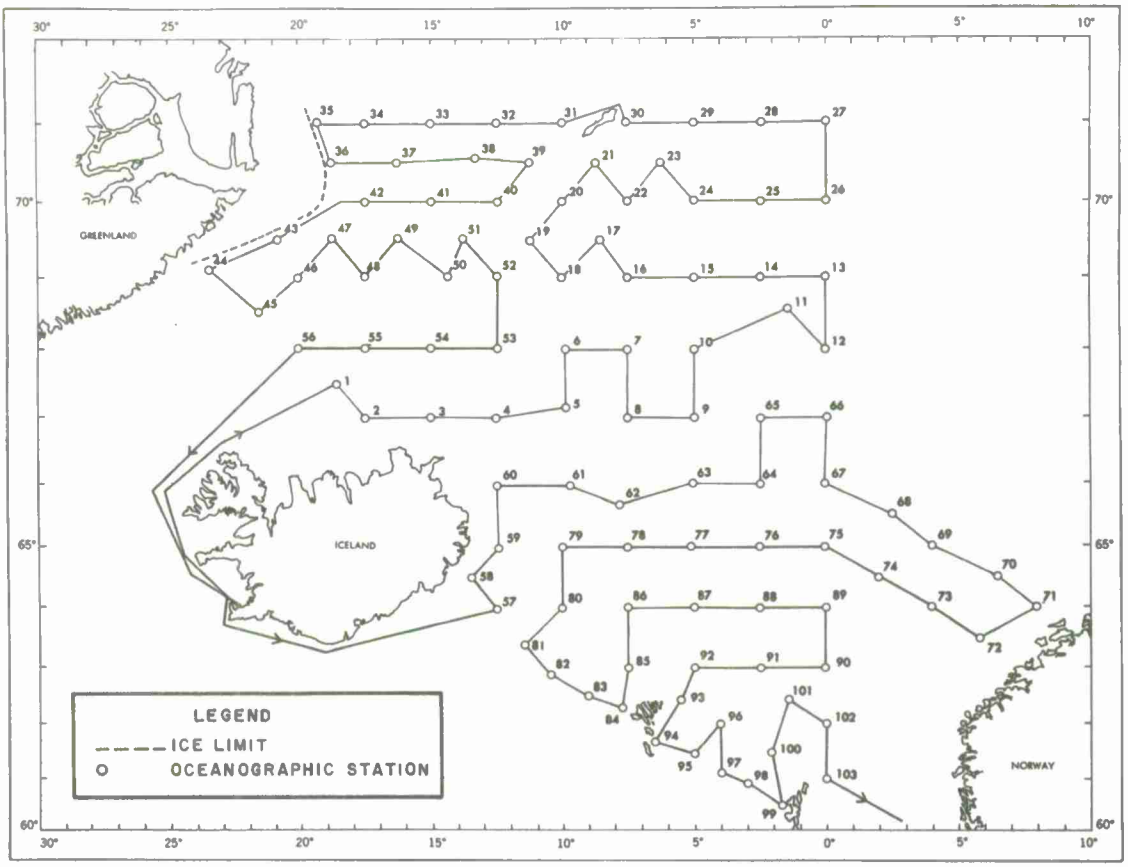


FIGURE 6 OCEANOGRAPHIC STATIONS TAKEN BY USS EDISTO (AGB-2), EASTERN ARCTIC, JULY-AUGUST 1963

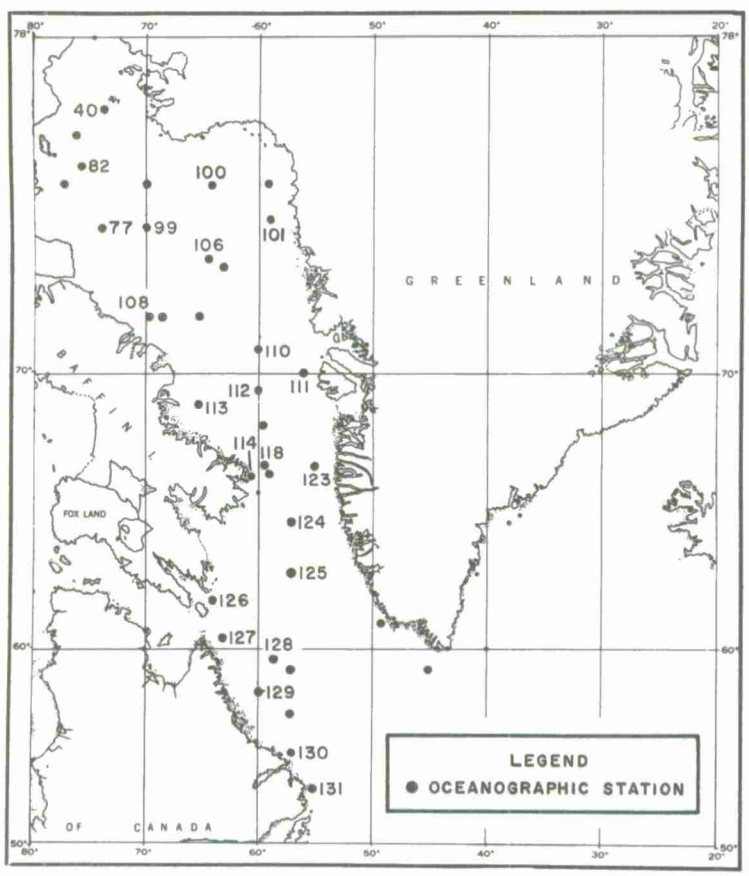


FIGURE 7 OCEANOGRAPHIC STATIONS TAKEN BY CCGC LABRADOR, SEPTEMBER-OCTOBER 1963

a total of 699 hours were conducted primarily over the polar basin during 1963. A summary of BIRDS EYE aerial reconnaissance is shown in figure 8. Data collected on each BIRDS EYE flight are published as special informal reports.

6. Observed Ice Conditions

Ice conditions observed in the eastern North American Arctic are shown in appendix A. The ice data, presented over 6-day periods, were obtained primarily from U.S. aerial ice reconnaissance supplemented by Canadian and Danish reconnaissance. Danish ice reconnaissance charts are presented in appendix B.

The outstanding feature of the ice season was the Ward Hunt Ice Island lodged in Kennedy Channel until late July. The island was first observed in northern Kennedy Channel on 25 February during a BIRDS EYE flight. It subsequently became lodged between Hans and Ellesmere Islands and was closely observed until breakup on 24 July. The ice island acted as a block and resulted in consolidated ice to the north and anomalous open water to ice-free conditions in Kane Basin during most of the season.

Near normal ice conditions existed over most of the eastern Arctic except for Goose Bay. Less than eight-tenths concentration occurred in the Goose Bay approaches about 23 June or about two weeks later than normal. Unescorted entry occurred about 10 days later than normal. Forecast and observed opening dates are shown in table 1.

Opening Dates				
	* Escorted		**Unescorted	
Station	1963 Outlook	Observed	1963 Outlook	Observed
Goose Bay	25 June	23 June	10 July	6 July
Thule	30 June	10 July	15 July	23 July
Kulusuk	20 July	16 July	15 August	15 August
Sondrestrom	25 May	20 May	1 June	8 June
Itivdleq	1 May	Prior 1 May	5 May	Prior 1 June

* <8/10 concentration
** <1/10 concentration

Table 1 Long-Range Ice Outlook Verification 1963

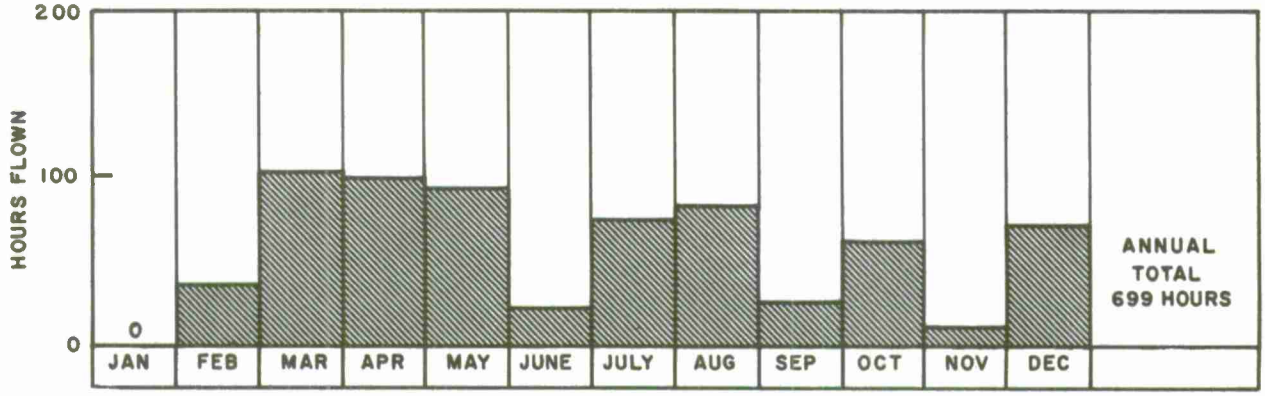


FIGURE 8 SUMMARY OF 1963 BIRDSEYE AERIAL ICE RECONNAISSANCE

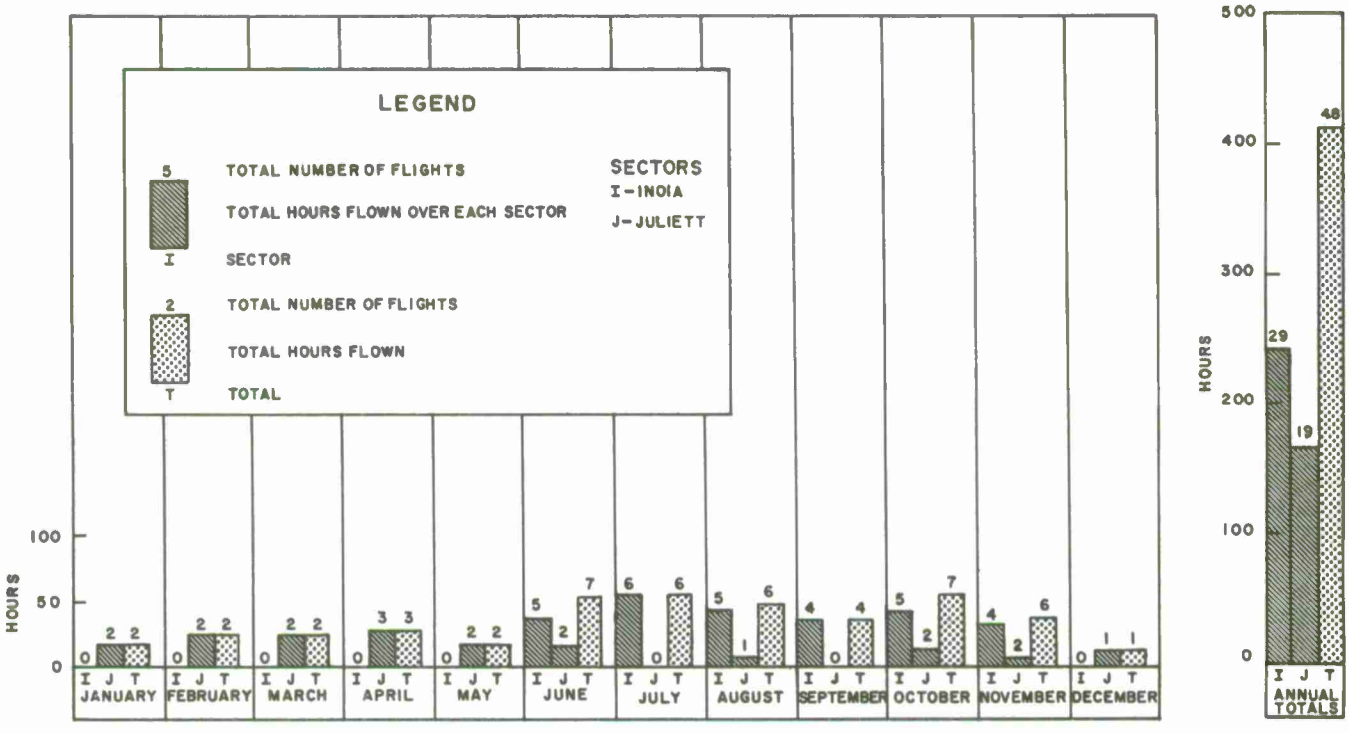


FIGURE 9 SUMMARY OF 1963 AERIAL ICE RECONNAISSANCE, WESTERN ARCTIC

PART II - WESTERN ARCTIC

1. General

Resupply operations were conducted by U.S. and Canadian commercial shipping companies, therefore, ice forecasting and reconnaissance supported military and oceanographic operations.

2. Ice Forecasting

a. Long-Range Outlook

No formal long-range outlook (SP-60 series) was published for the western Arctic in 1963. Only general long-range conditions were described during oral briefings for COMSTS and COMSTSLANT.

b. Short- and Long-Range Ice Forecasts

Thirty-day ice forecasts for the north Alaskan coast and the Chukchi and Bering Seas were issued twice monthly to COMALSEAFRON throughout the year. The forecasts included pack boundaries, concentrations, and ice thickness for specified points. A total of twenty-four 30-day ice forecasts was issued.

Four 30-day and five 15-day forecasts were provided for the USCGC NORTHWIND and USS STATEN ISLAND cruises conducted during summer and autumn of 1963.

Beginning with the 1963 season, the Naval Weather Service assumed responsibility for short-range ice forecasting in the western Arctic. Fleet Weather Central, Kodiak, provided short-range ice forecasting and ship routing service in the western Arctic.

3. Ice Reconnaissance

Aerial ice reconnaissance over sectors India and Juliett was conducted primarily by SP2E long-range aircraft under the command of COMALSEAFRON. These flights were conducted twice monthly throughout the year. In addition, monthly BIRDS EYE flights supplemented the long-range data. Short-range ice reconnaissance was conducted by ship-based helicopters.

A summary of hours flown and the number of flights made over each western sector for each month during 1963 as well as the monthly and annual totals is presented as figure 9.

4. Communications

Because no local support was required for Alaskan resupply operations, communications consisted of existing U.S. Navy and Air Force circuits which were used to transmit all traffic between Washington and the western Arctic.

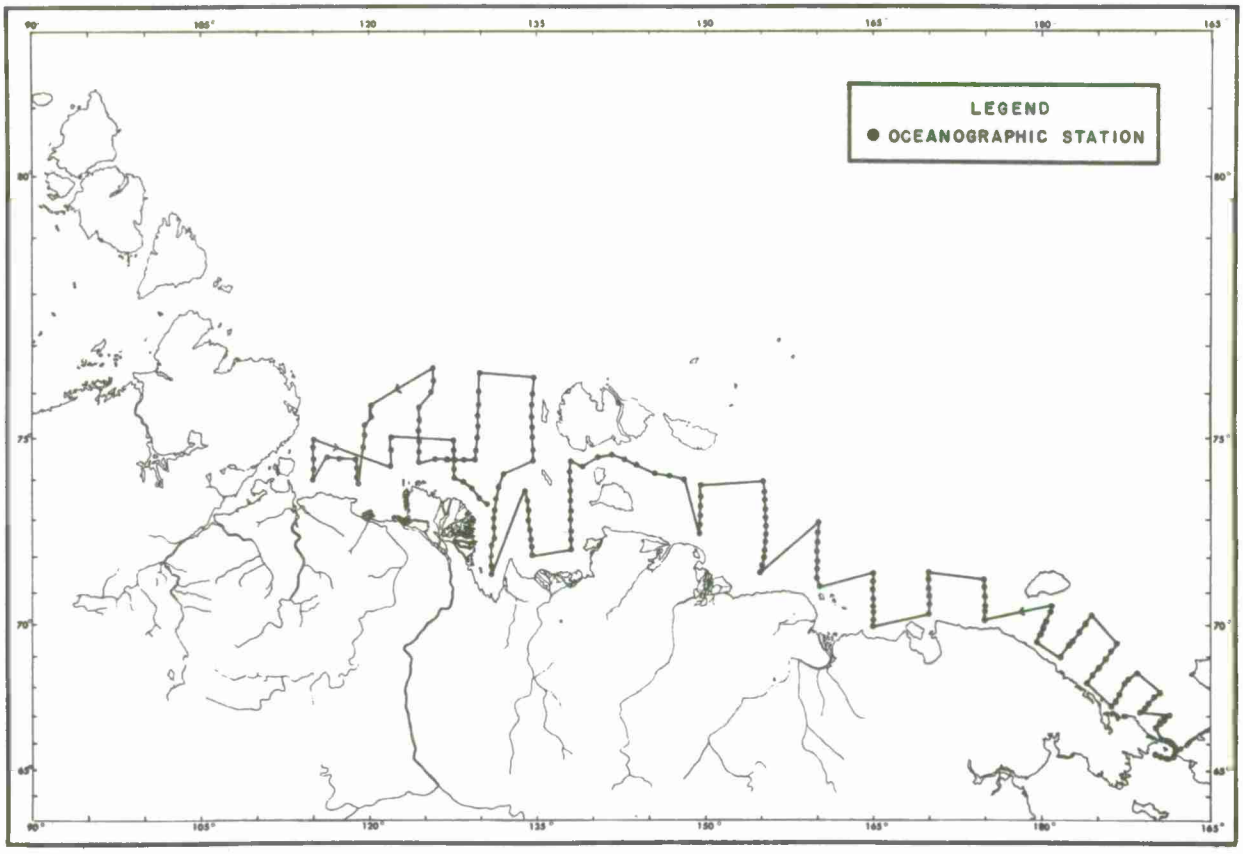


FIGURE 10 OCEANOGRAPHIC STATIONS TAKEN BY USCGC NORTHWIND (WAGB-282), WESTERN ARCTIC, AUGUST-SEPTEMBER 1963

5. Supporting Projects

a. USCGC NORTHWIND

From 9 August until 19 September the USCGC NORTHWIND conducted an oceanographic cruise along the north Siberian coast in the East Siberian and Laptev Seas. In addition to taking oceanographic stations, detailed observations and photographs of existing ice conditions were made. A NAVOCEANO oceanographer was aboard the NORTHWIND throughout the entire cruise. Figure 10 shows the locations of the stations occupied by the NORTHWIND. Ice conditions observed by the NORTHWIND during its cruise are included in appendix C.

b. USS STATEN ISLAND

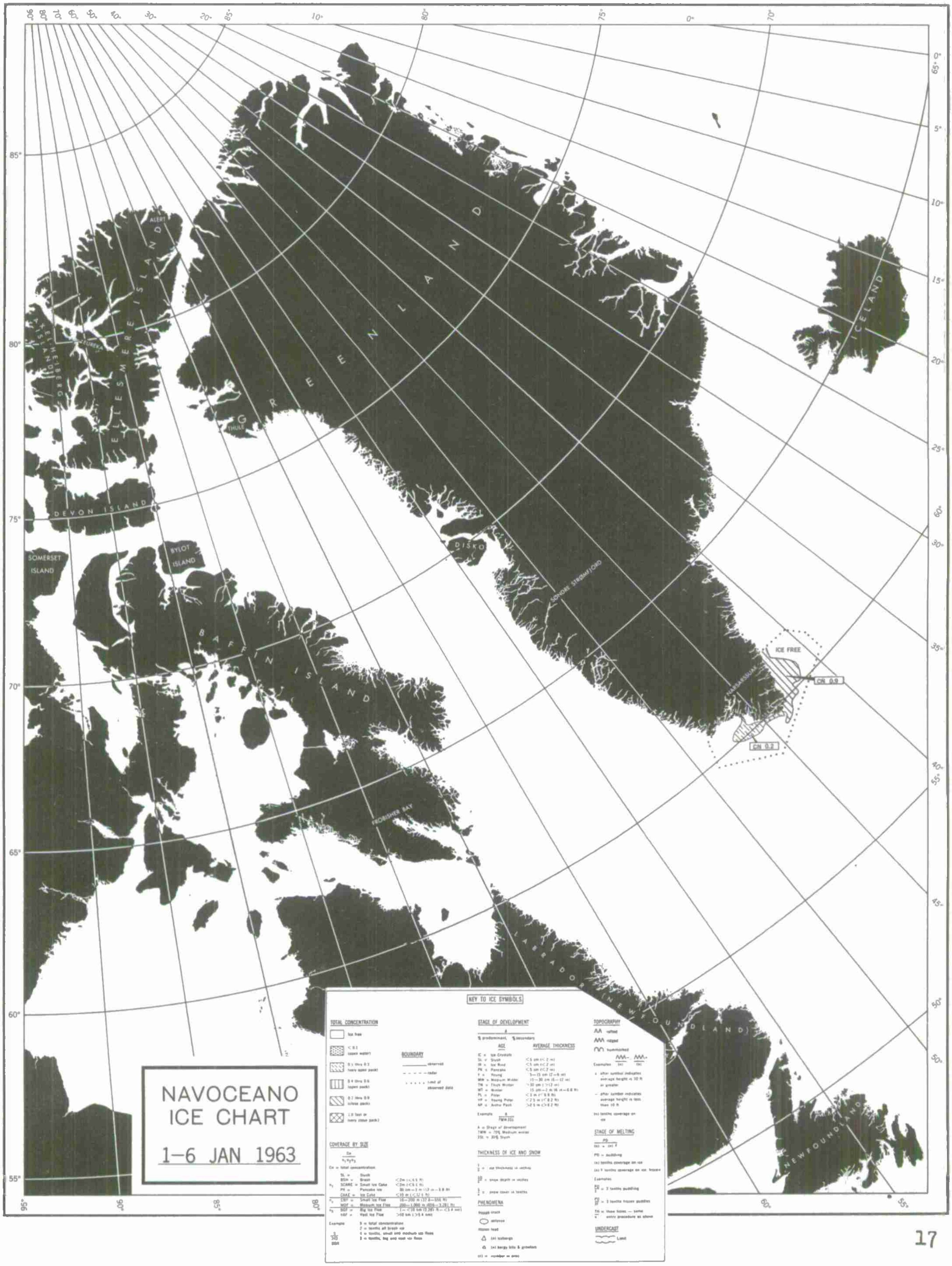
From 13 September to 22 November the USS STATEN ISLAND conducted a cruise in the Chukchi Sea. The oceanographic data obtained from these cruises are on file at the National Oceanographic Data Center, Washington, D.C.

6. Observed Ice Conditions

Ice conditions in the western North American Arctic are presented in appendix C.

APPENDIX A

EASTERN ARCTIC ICE CHARTS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1–6 JAN 1963
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ELLESMERE ISLAND
AXEL HEIBERG ISLAND
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EUREKA
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BAFFIN ISLAND
FROBISHER BAY
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LABRADOR (NEWFOUNDLAND)
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KEY TO ICE SYMBOLS
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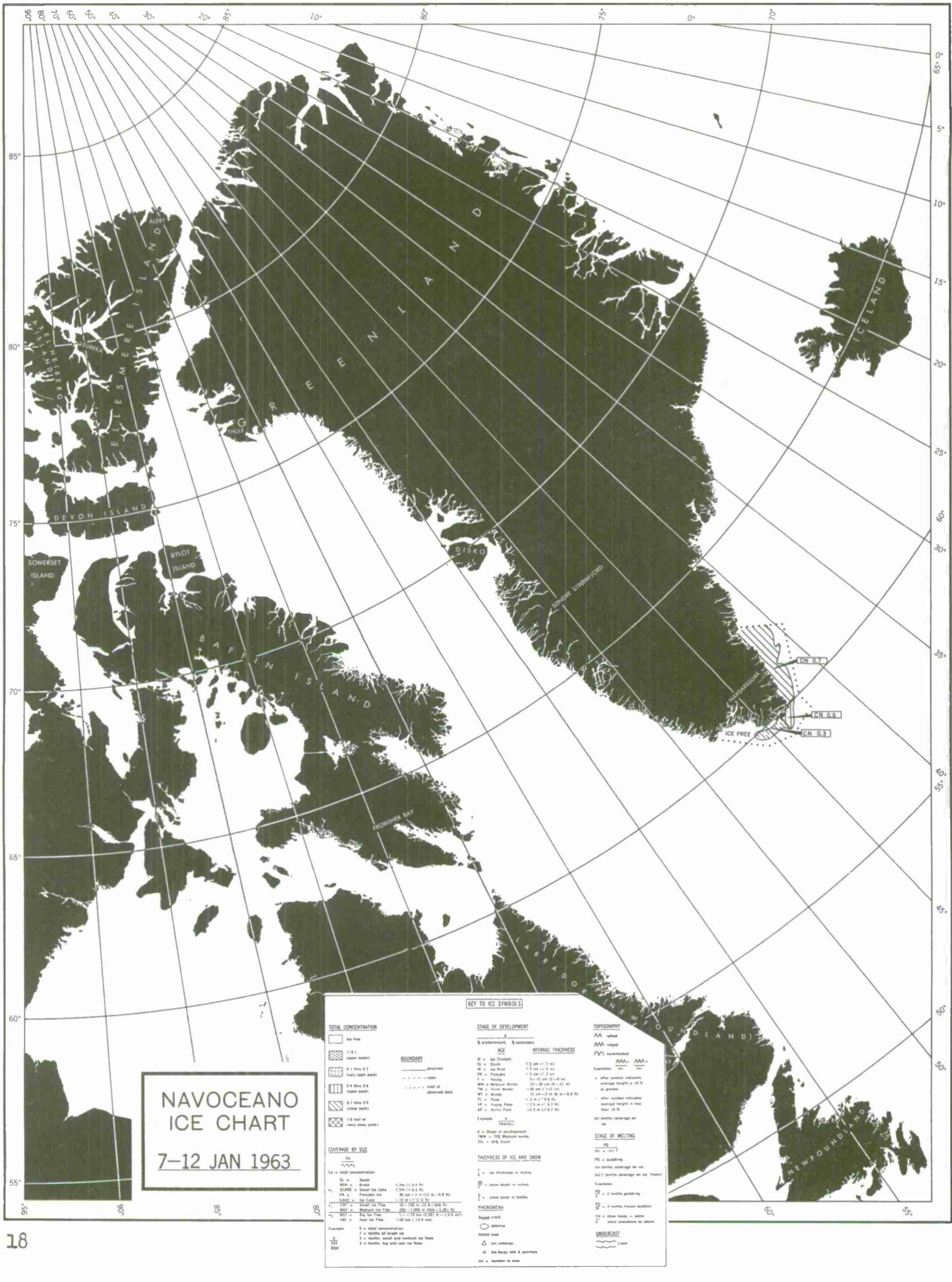
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CN 0.3
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PD = puddling
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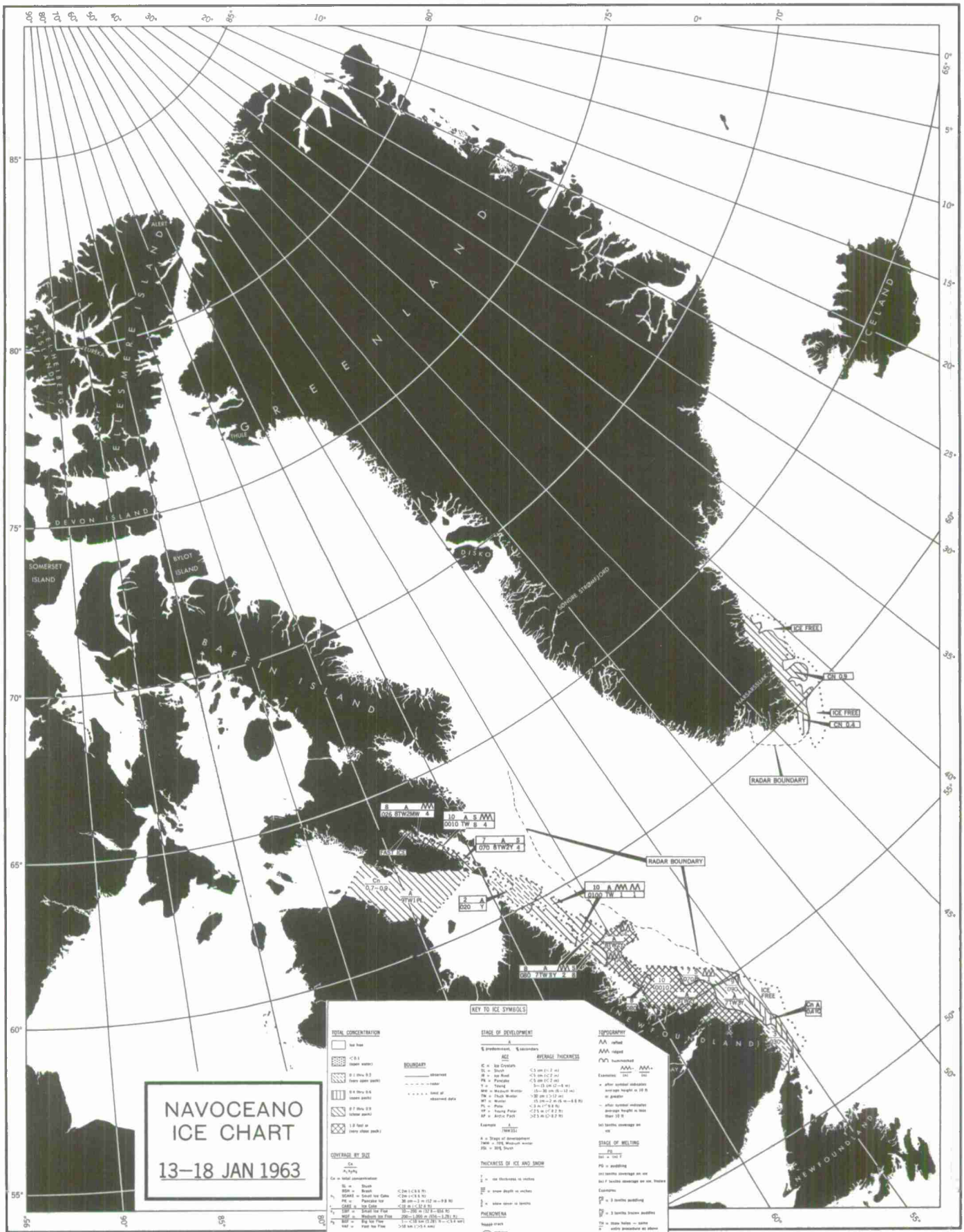
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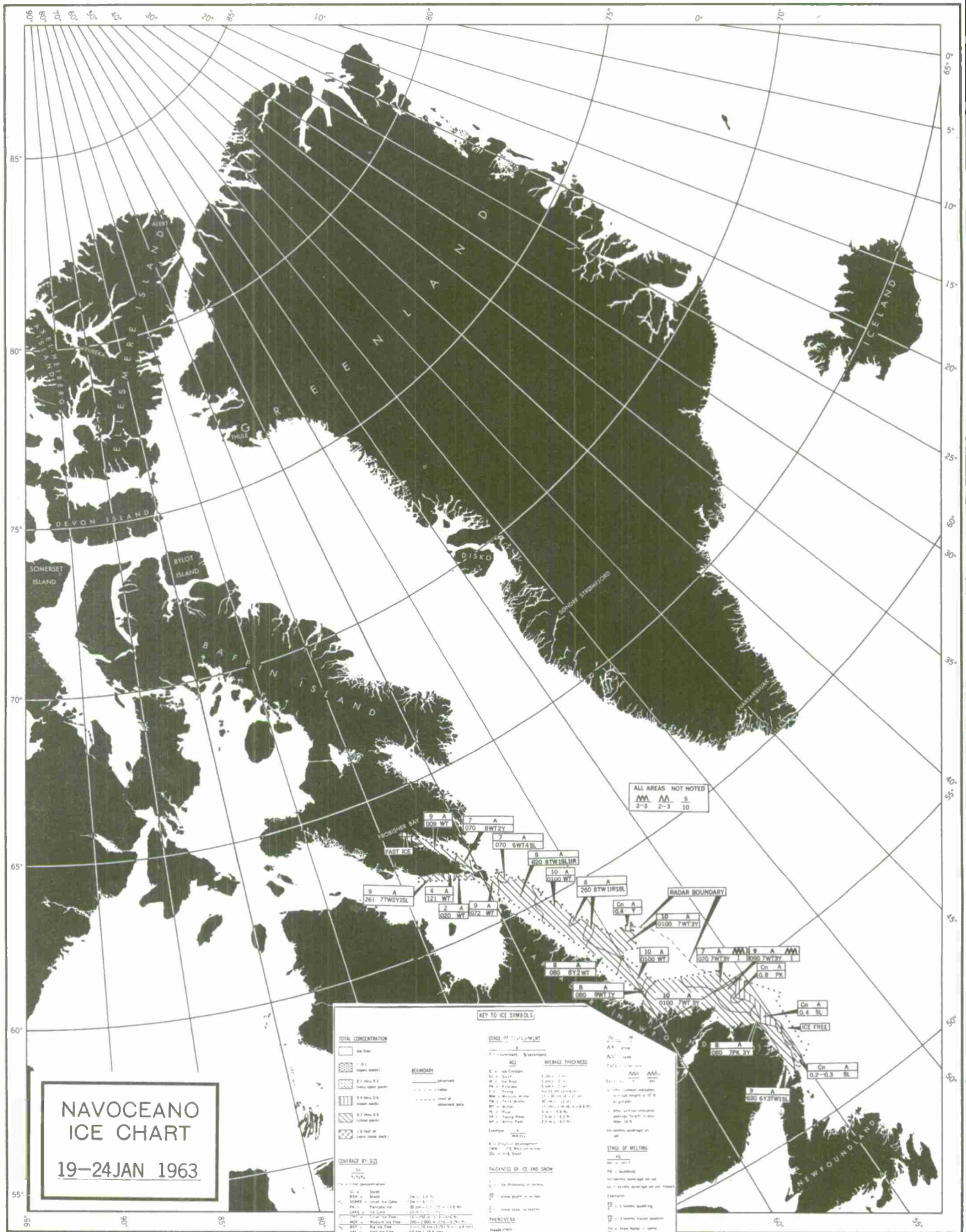
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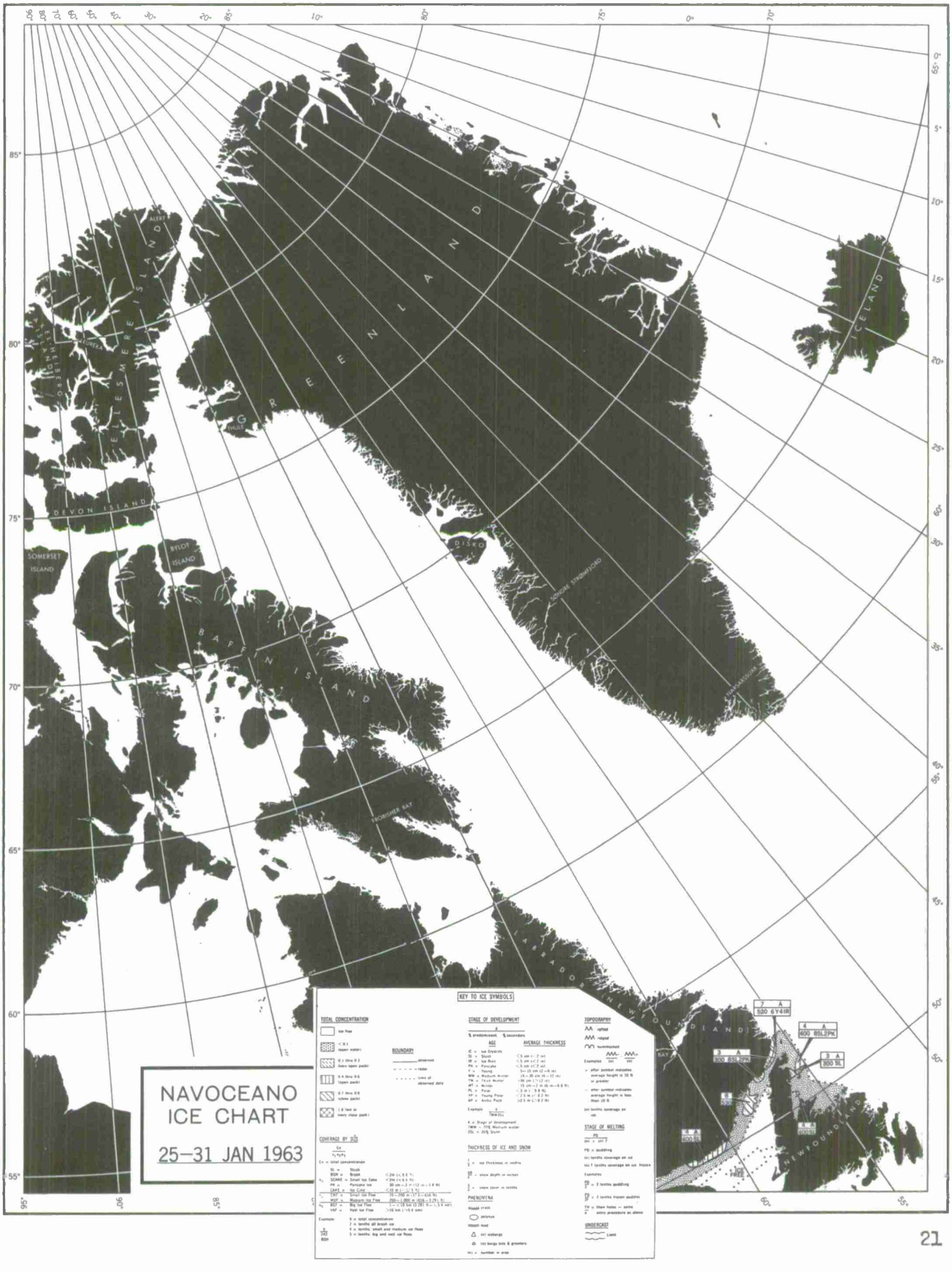

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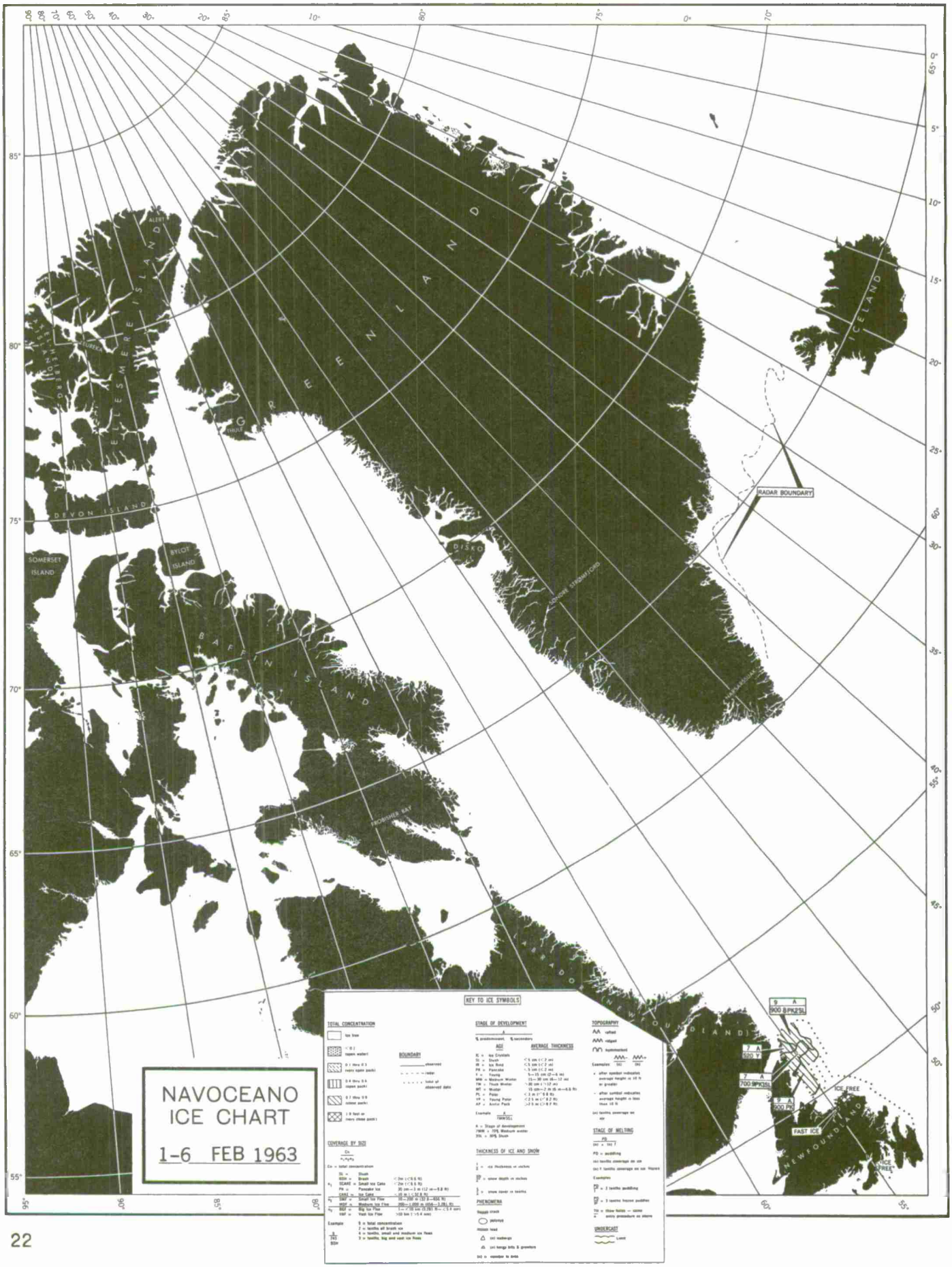
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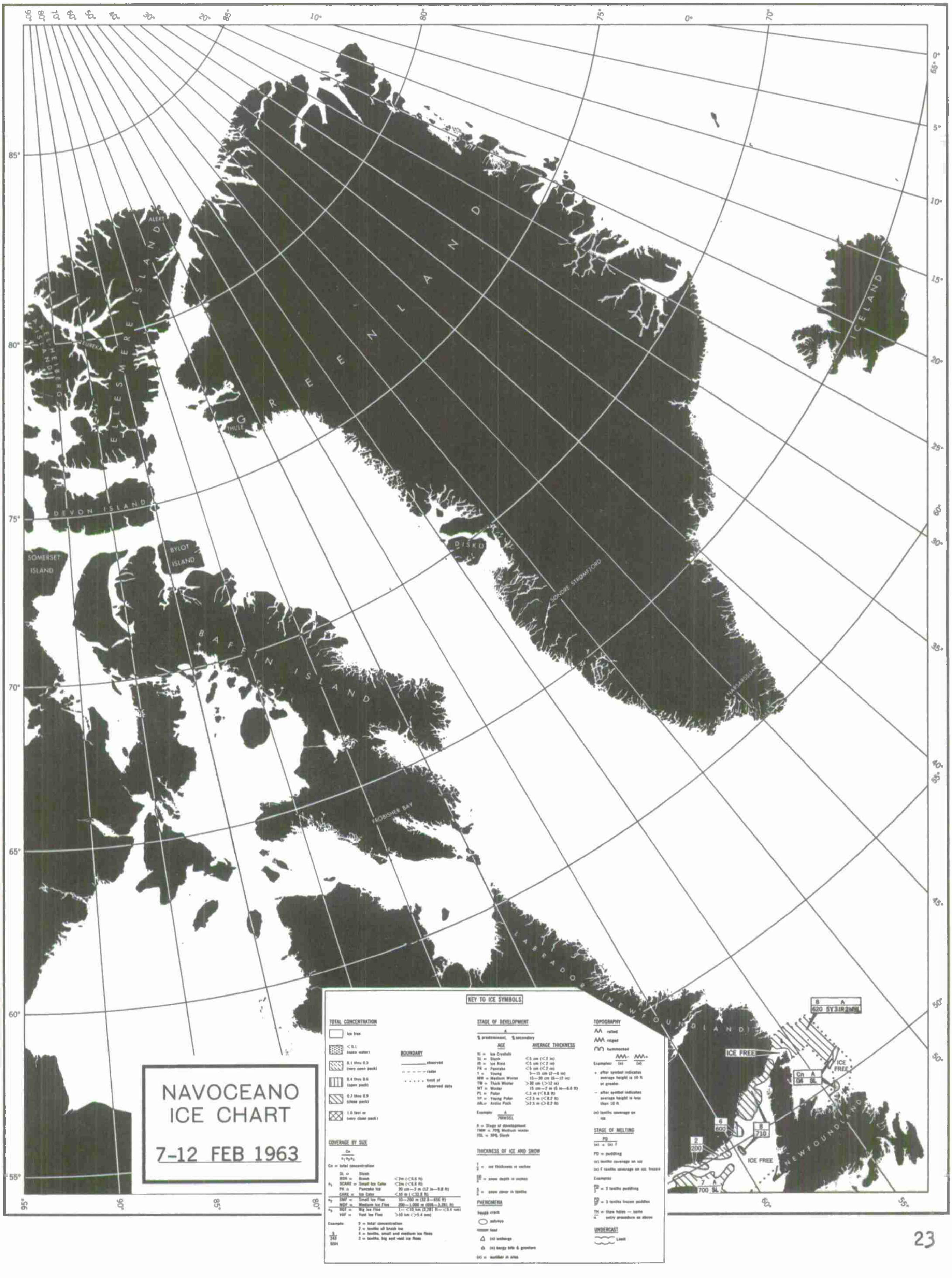
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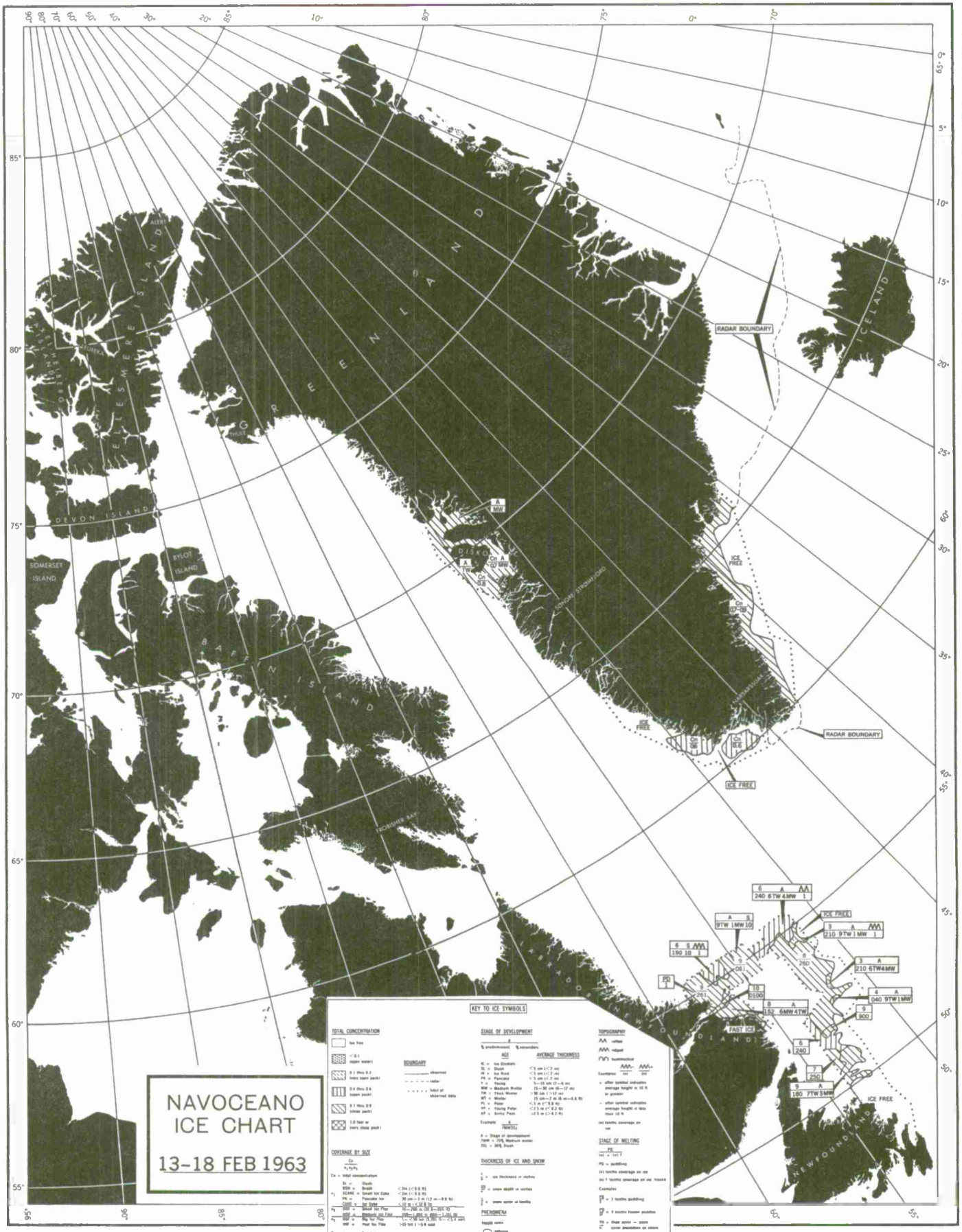
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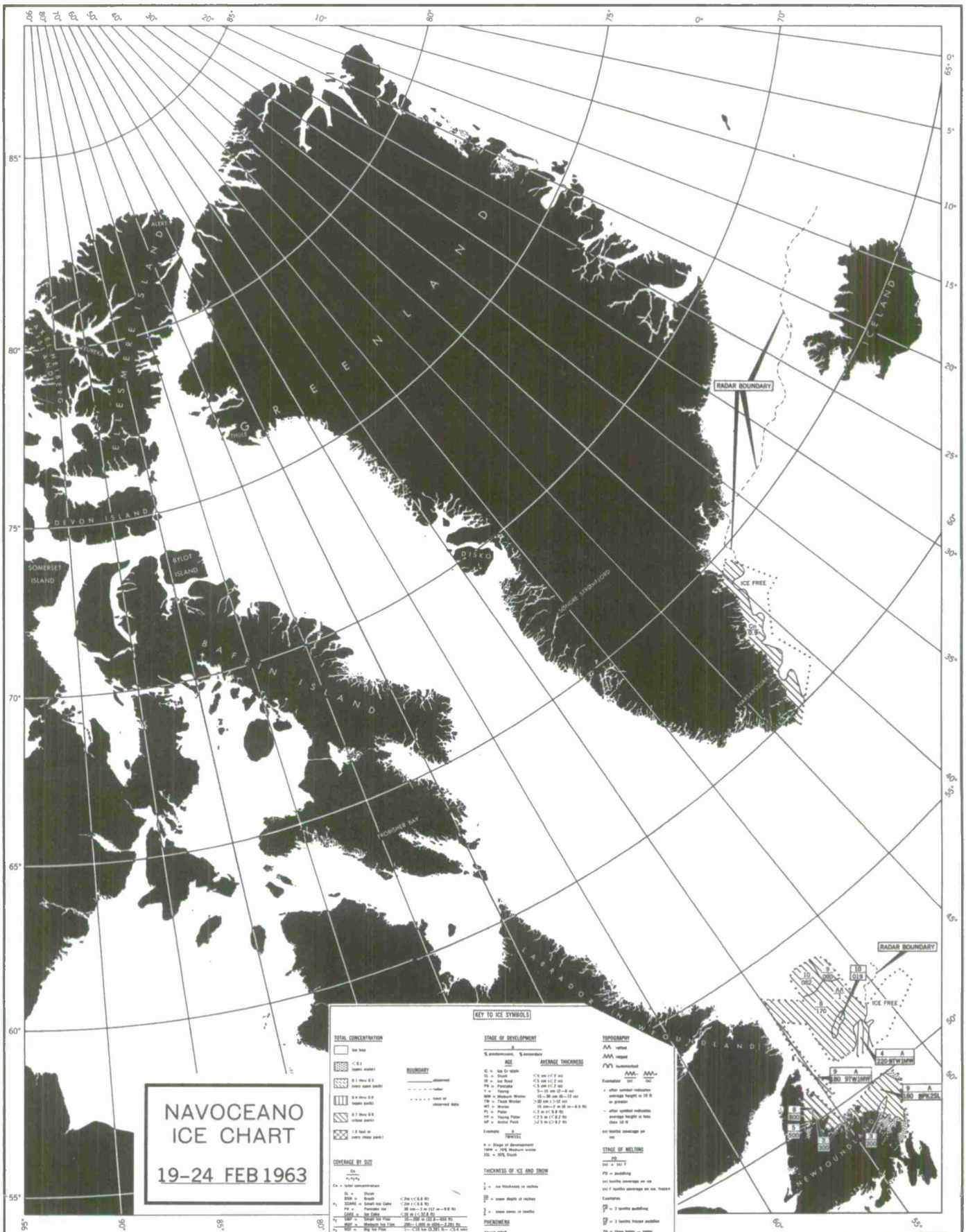
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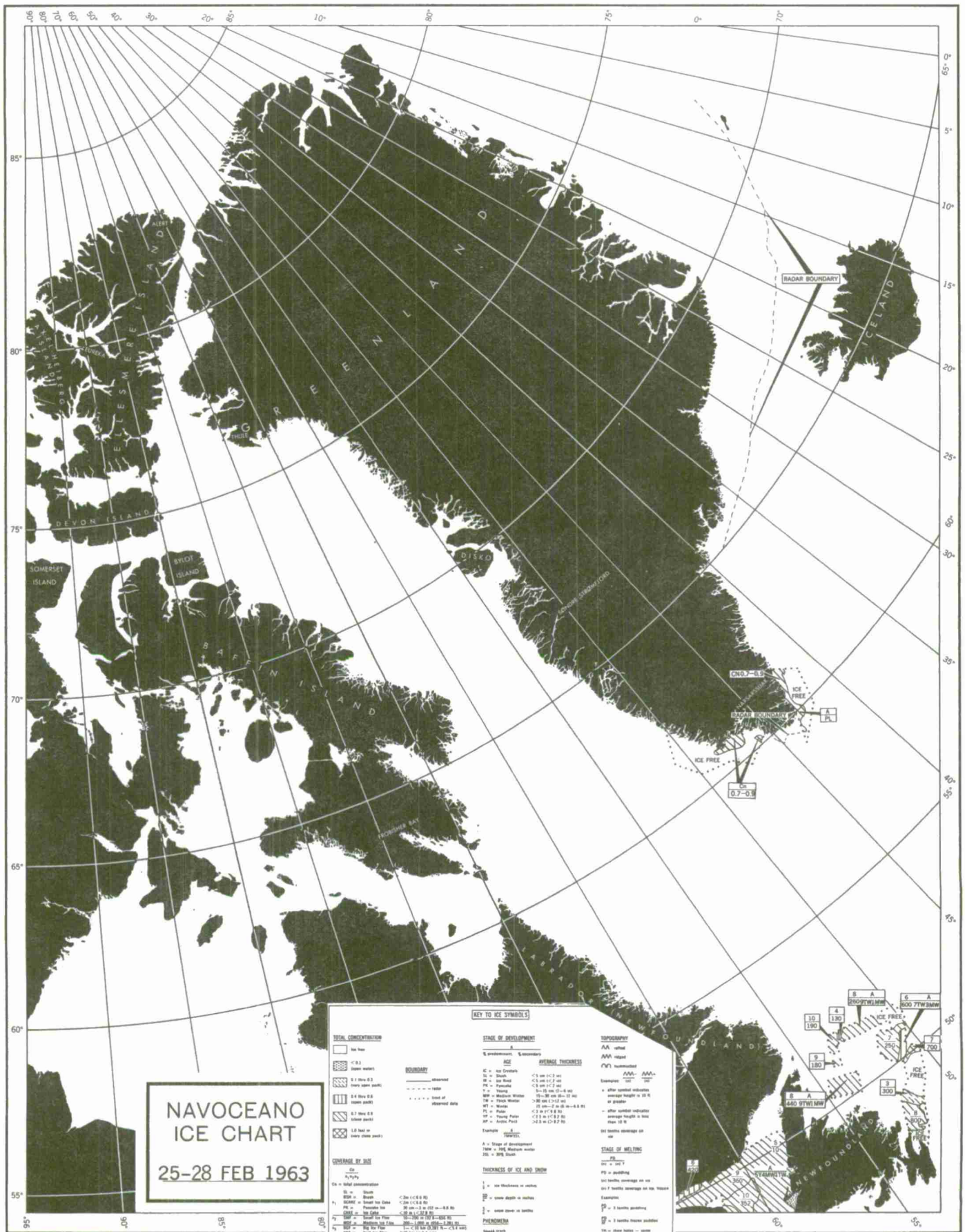
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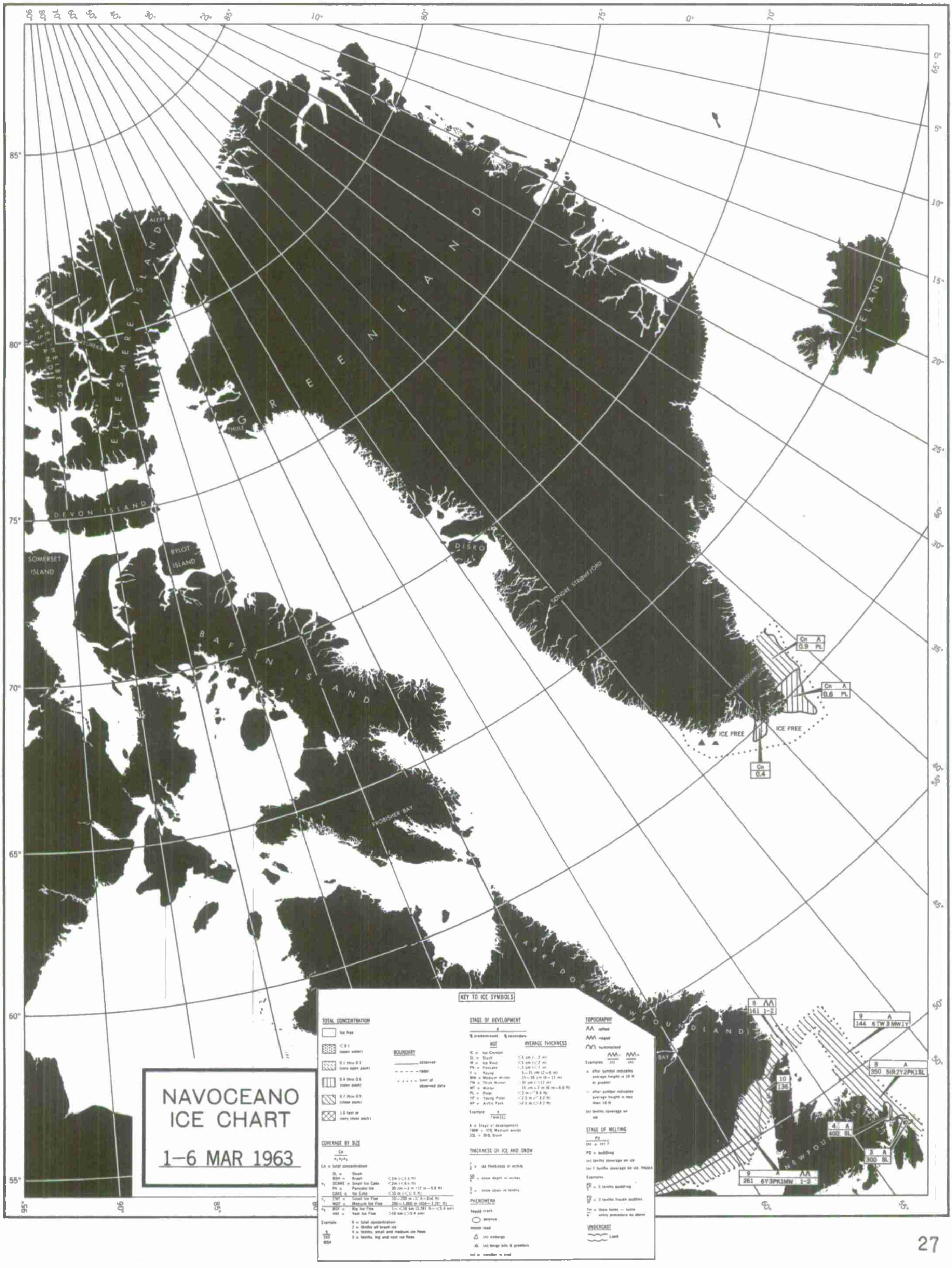
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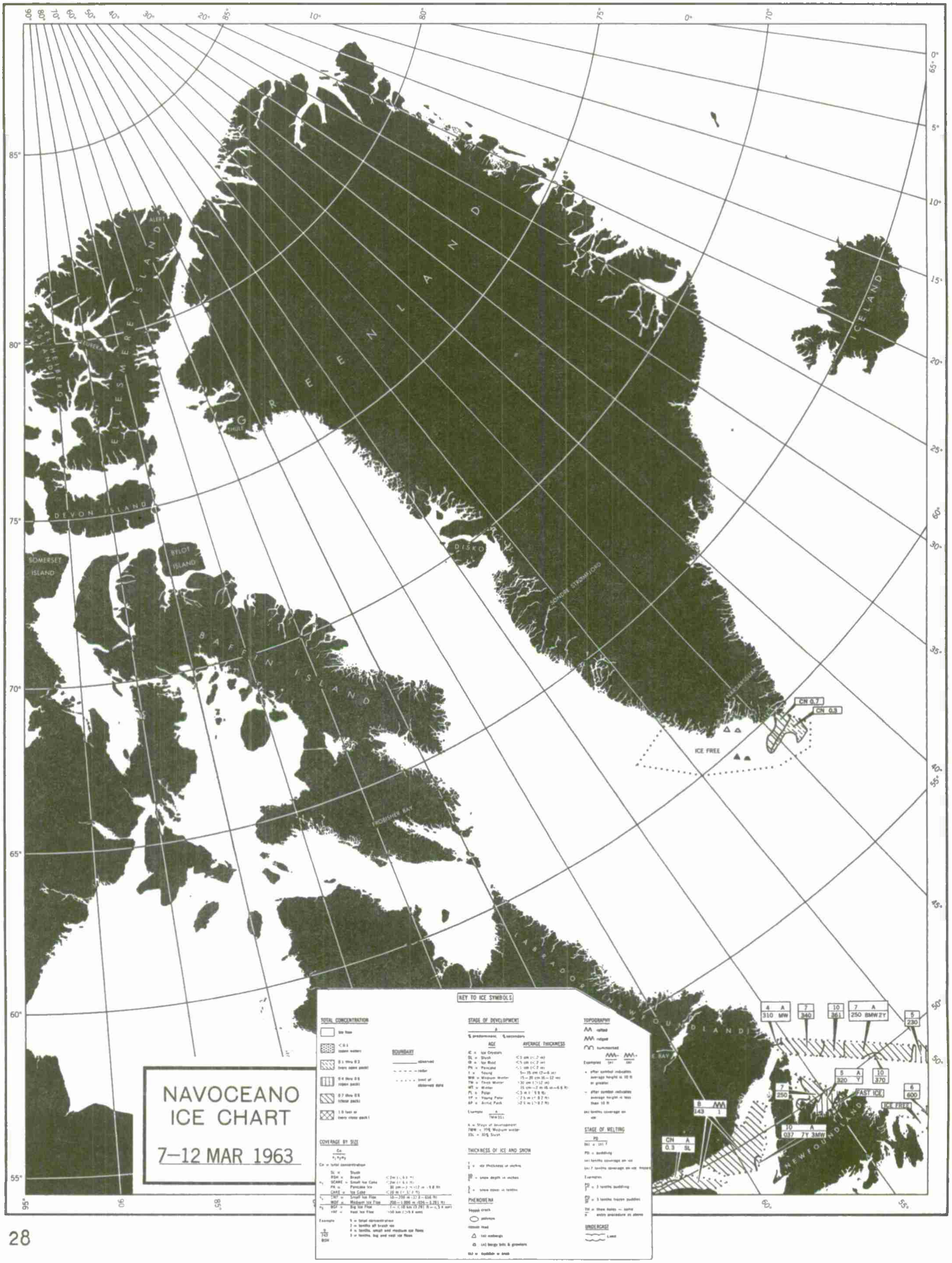
1–6 MAR 1963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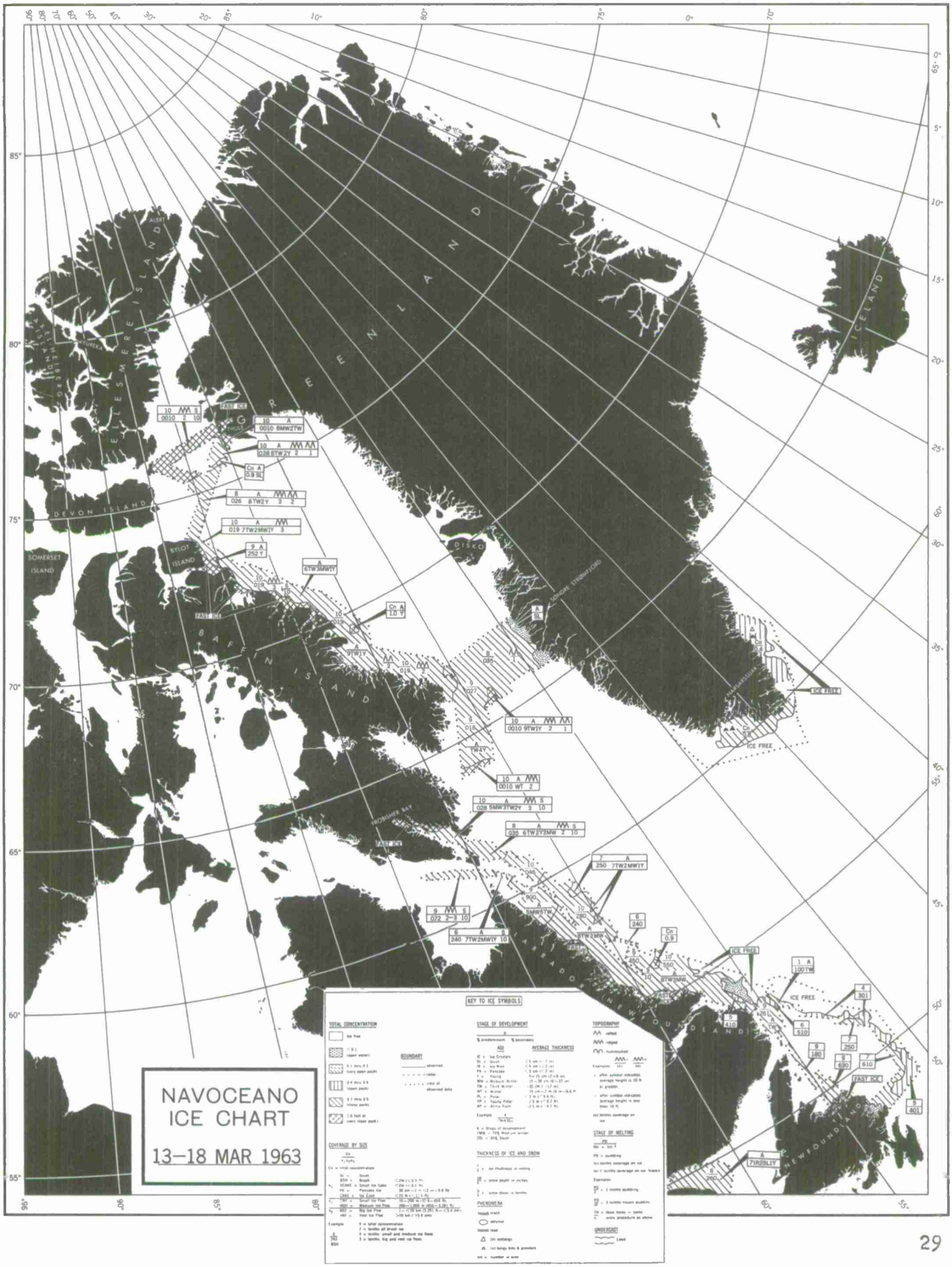
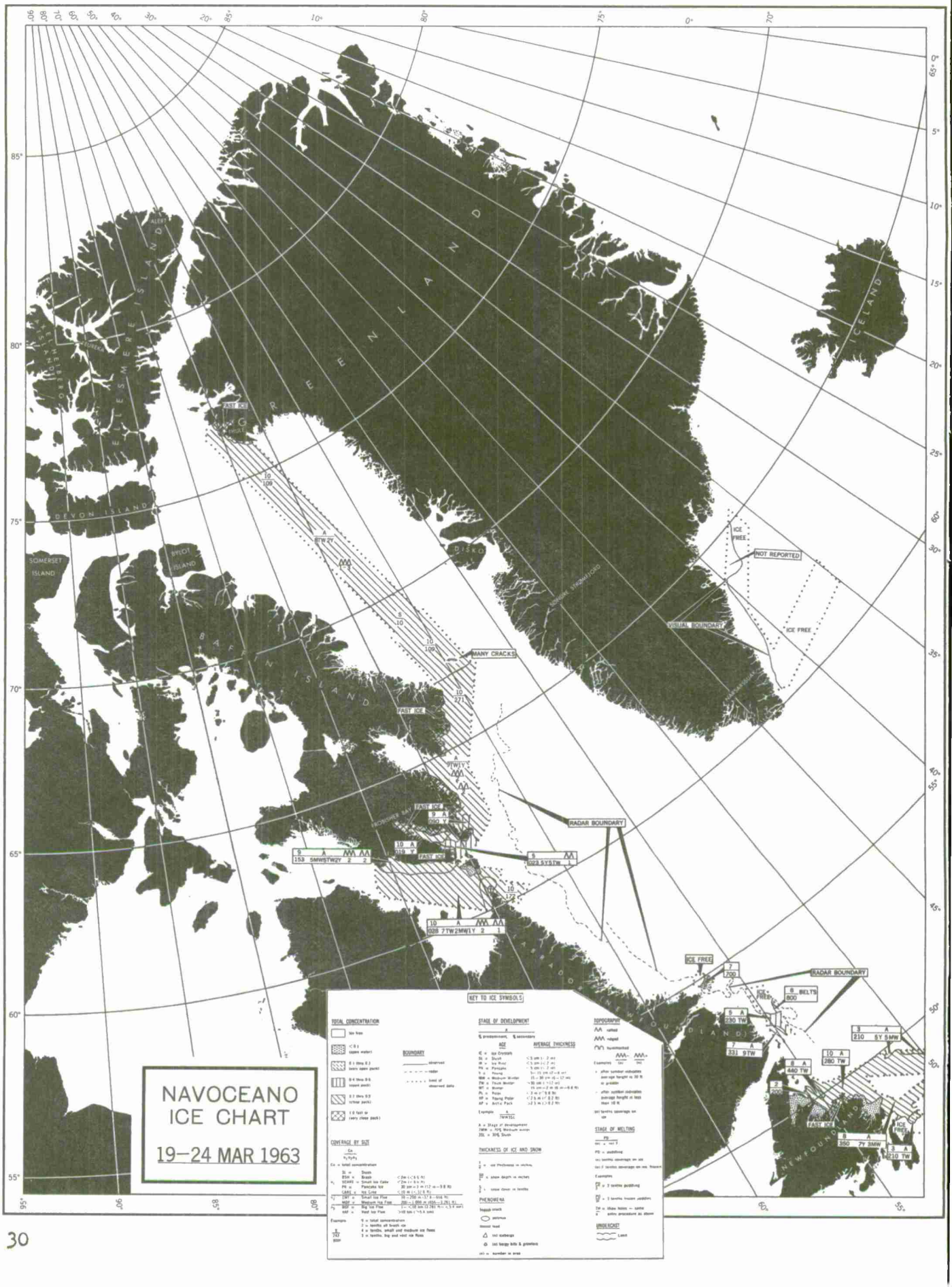
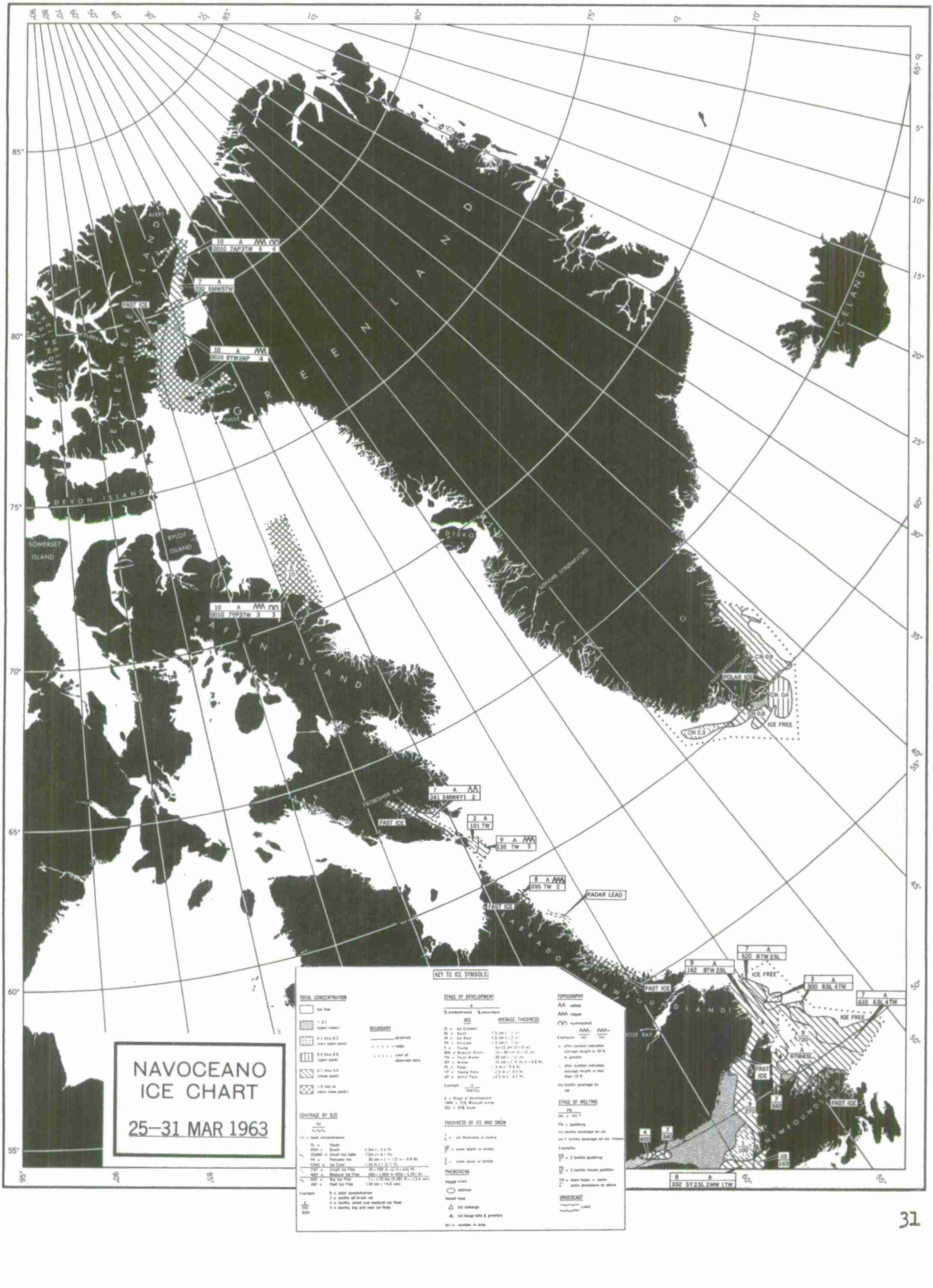
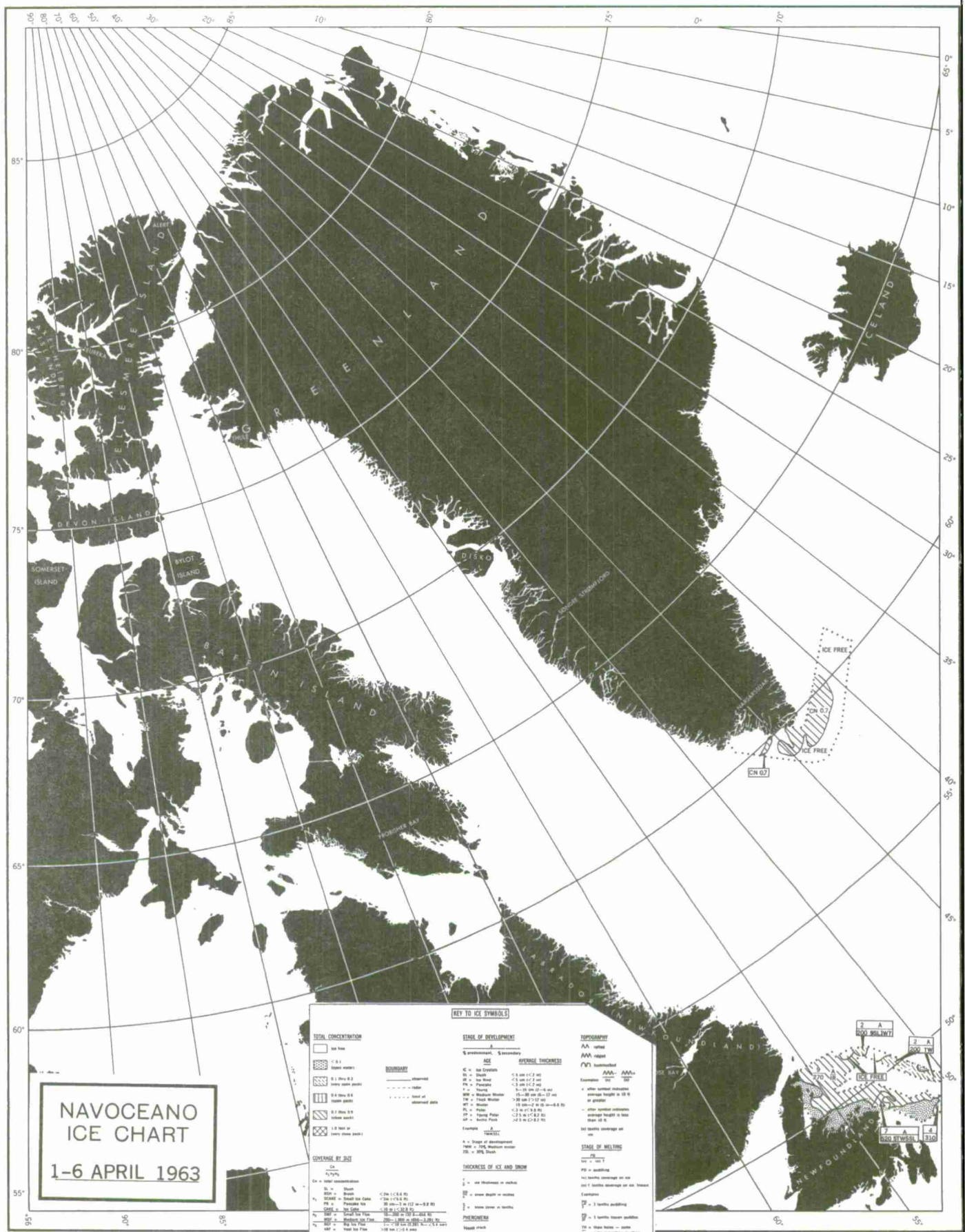
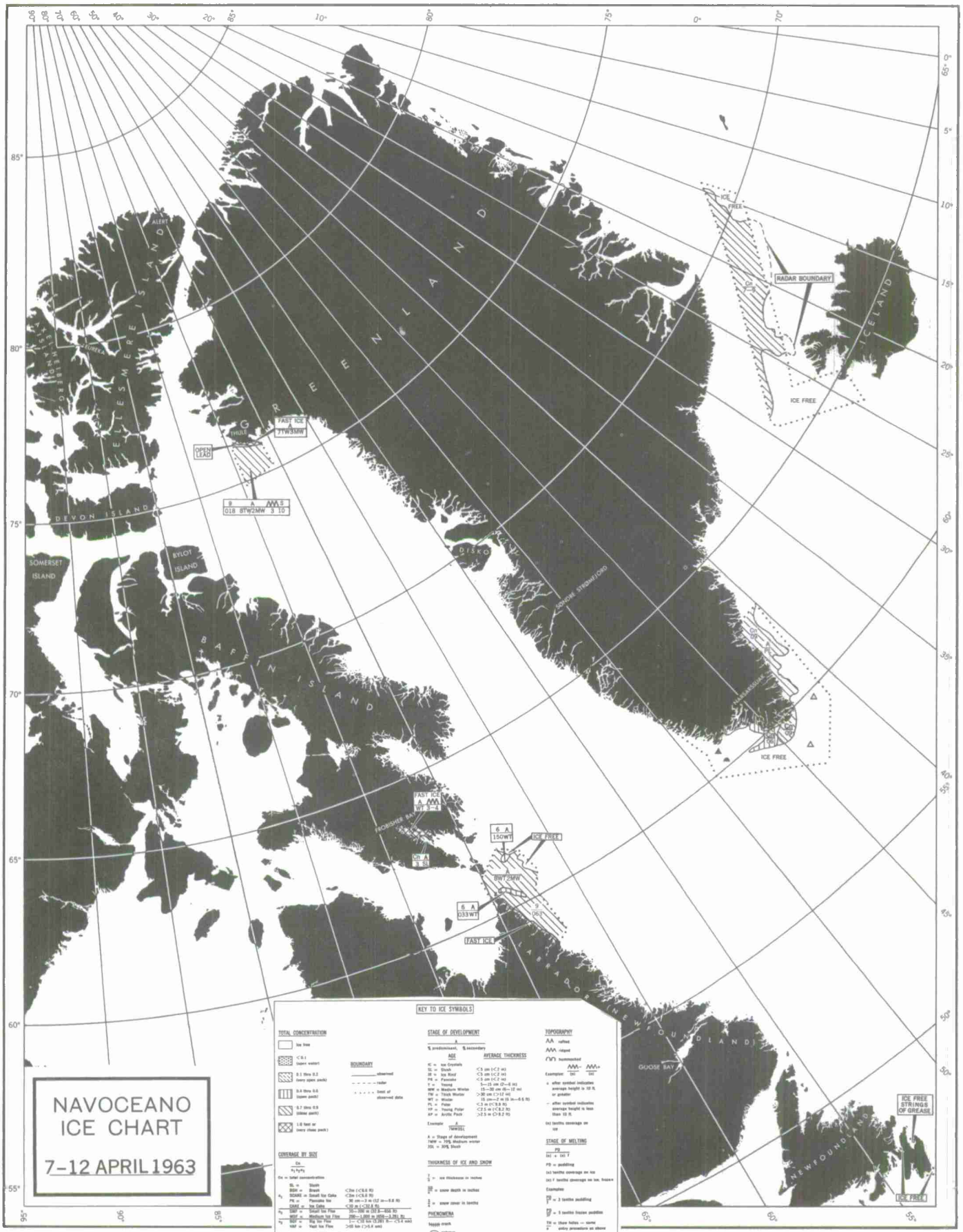

NAVOCEANO
ICE CHART
13–18 MAR 1963
KEY TO ICE SYMBOLS
GREENLAND
ELLESMERE ISLAND
DEVON ISLAND
SOMERSET ISLAND
BAFFIN ISLAND
ICELAND
NEWFOUNDLAND
LABRADOR
FAST ICE
ICE FREE


NAVOCEANO
ICE CHART
19–24 MAR 1963
KEY TO ICE SYMBOLS
TOTAL CONCENTRATION
BOUNDARY
COVERAGE BY EGG
STAGE OF DEVELOPMENT
AVERAGE THICKNESS
TOPOGRAPHY
STAGE OF MELTING
THICKNESS OF ICE AND SNOW
PHENOMENA
UNDERWATER
GREENLAND
ICELAND
DEVON ISLAND
SOMERSET ISLAND
PYLOT ISLAND
BAFFIN ISLAND
NEWFOUNDLAND
LABRADOR
FAST ICE
MANY CRACKS
RADAR BOUNDARY
ICE FREE
NOT REPORTED
ORIGINAL BOUNDARY



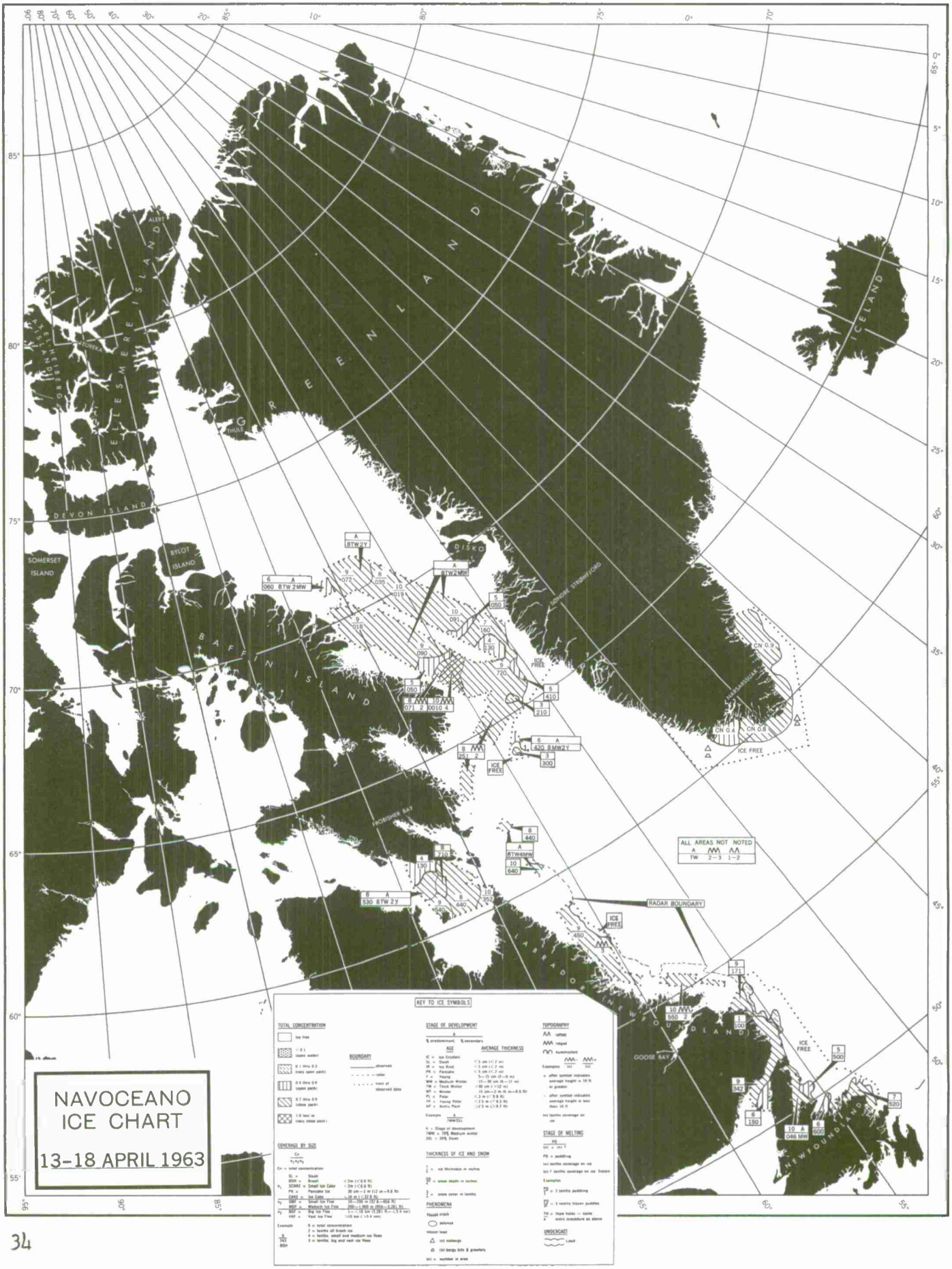
NAVOCEANO
ICE CHART
25–31 MAR 1963
GREENLAND
ICELAND
ELLESMERE ISLAND
AXEL HEIBERG ISLAND
DEVON ISLAND
SOMERSET ISLAND
BYLOT ISLAND
BAFFIN ISLAND
DISKO
SØNDRE STRØMFJORD
FROBISHER BAY
LABRADOR
NEWFOUNDLAND
ALERT
EUREKA
THULE
FAST ICE
POLAR ICE
ICE FREE
RADAR LEAD
KEY TO ICE SYMBOLS
TOTAL CONCENTRATION
BOUNDARY
STAGE OF DEVELOPMENT
AGE
AVERAGE THICKNESS
TOPOGRAPHY
COVERAGE BY SIZE
THICKNESS OF ICE AND SNOW
STAGE OF MELTING
PHENOMENA
UNDERCAST

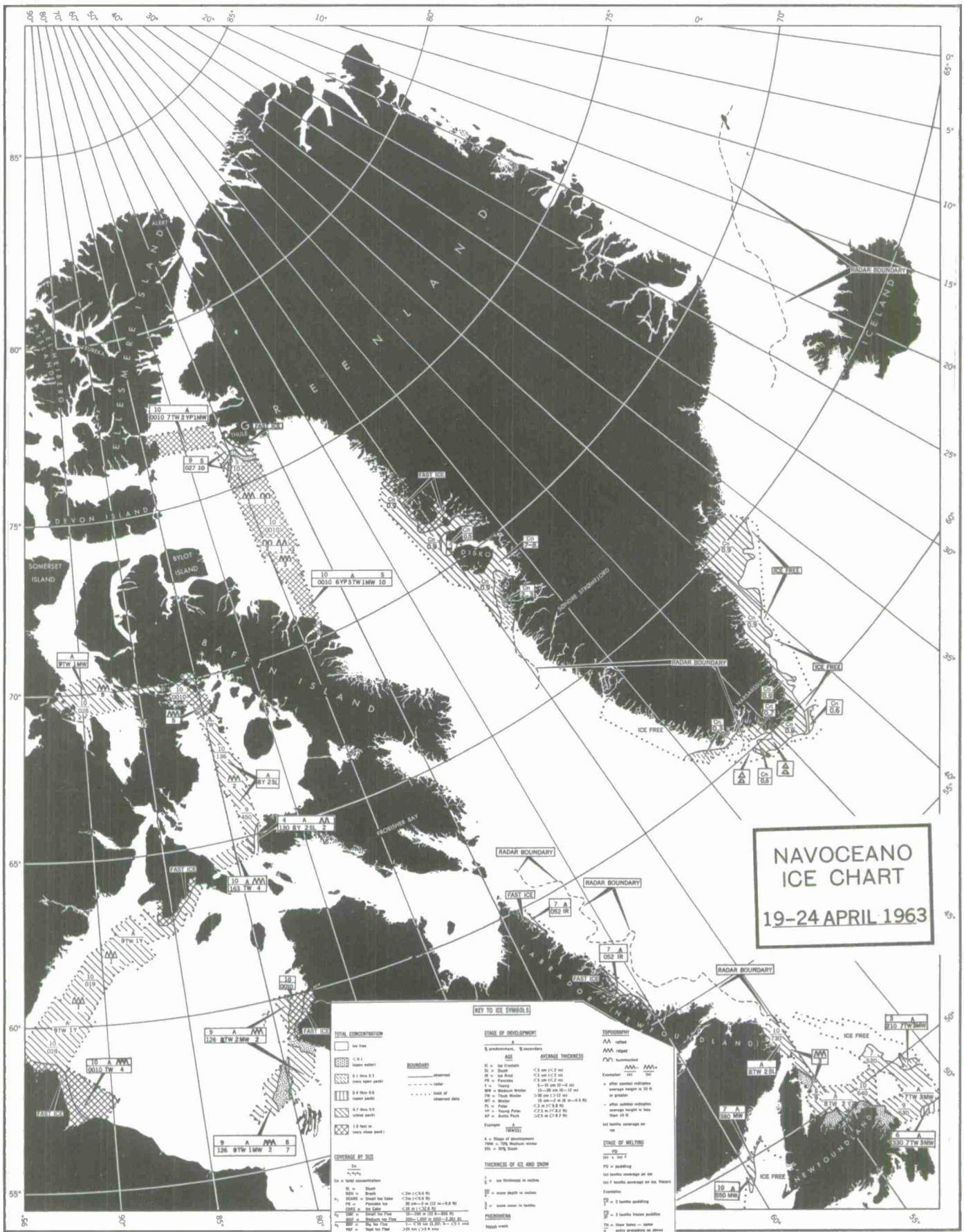

NAVOCEANO
ICE CHART
1-6 APRIL 1963
KEY TO ICE SYMBOLS
TOTAL CONCENTRATION
COVERAGE BY SIZE
STAGE OF DEVELOPMENT
AVERAGE THICKNESS
THICKNESS OF ICE AND SNOW
PHENOMENA
TOPOGRAPHY
STAGE OF MELTING
UNDERCAST
BOUNDARY
GREENLAND
ICELAND
DEVON ISLAND
SOMERSET ISLAND
BYLOT ISLAND
BAFFIN ISLAND
DISKO
NEWFOUNDLAND
LABRADOR
ICE FREE
CN 07
ICE FREE

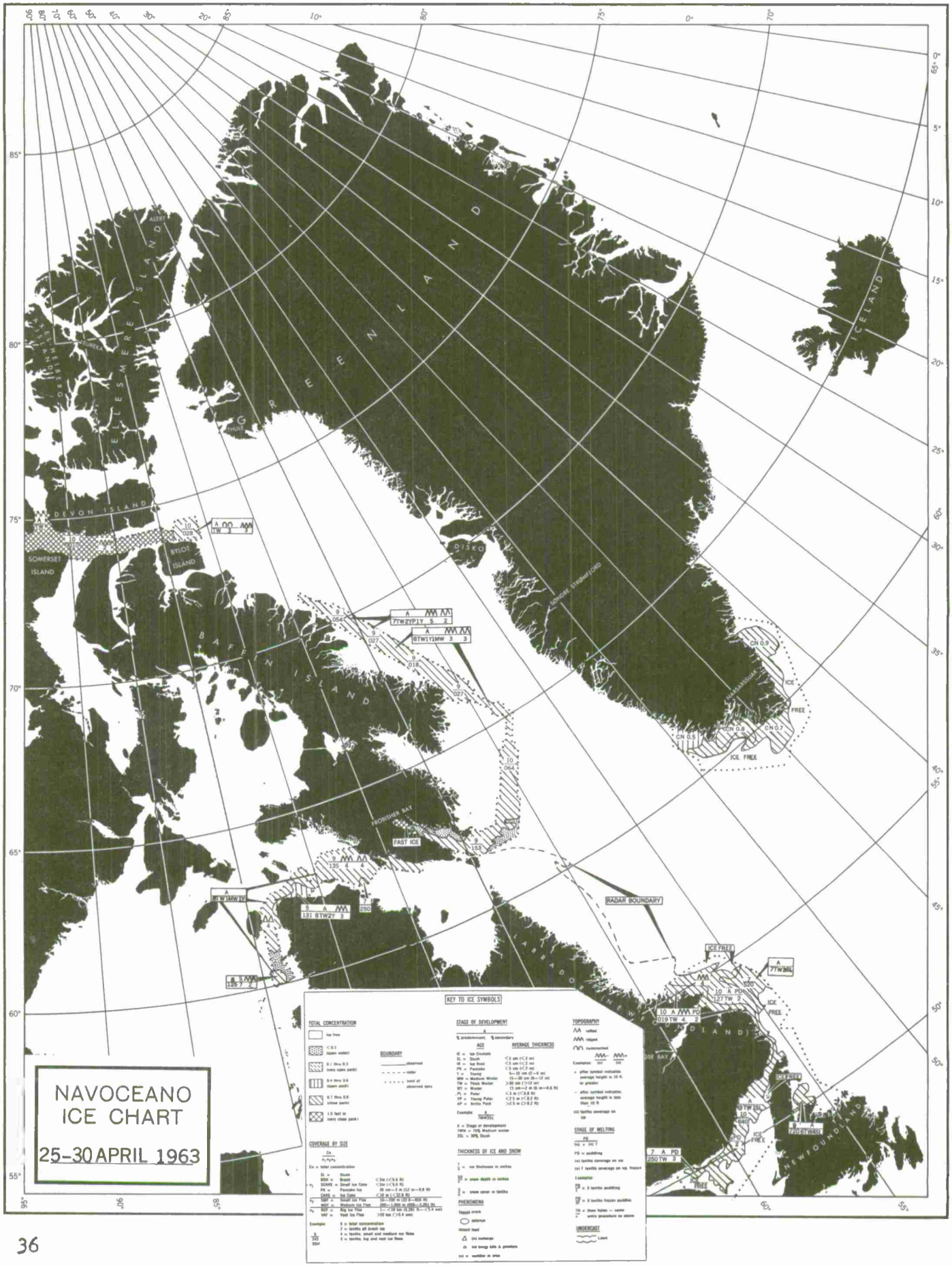


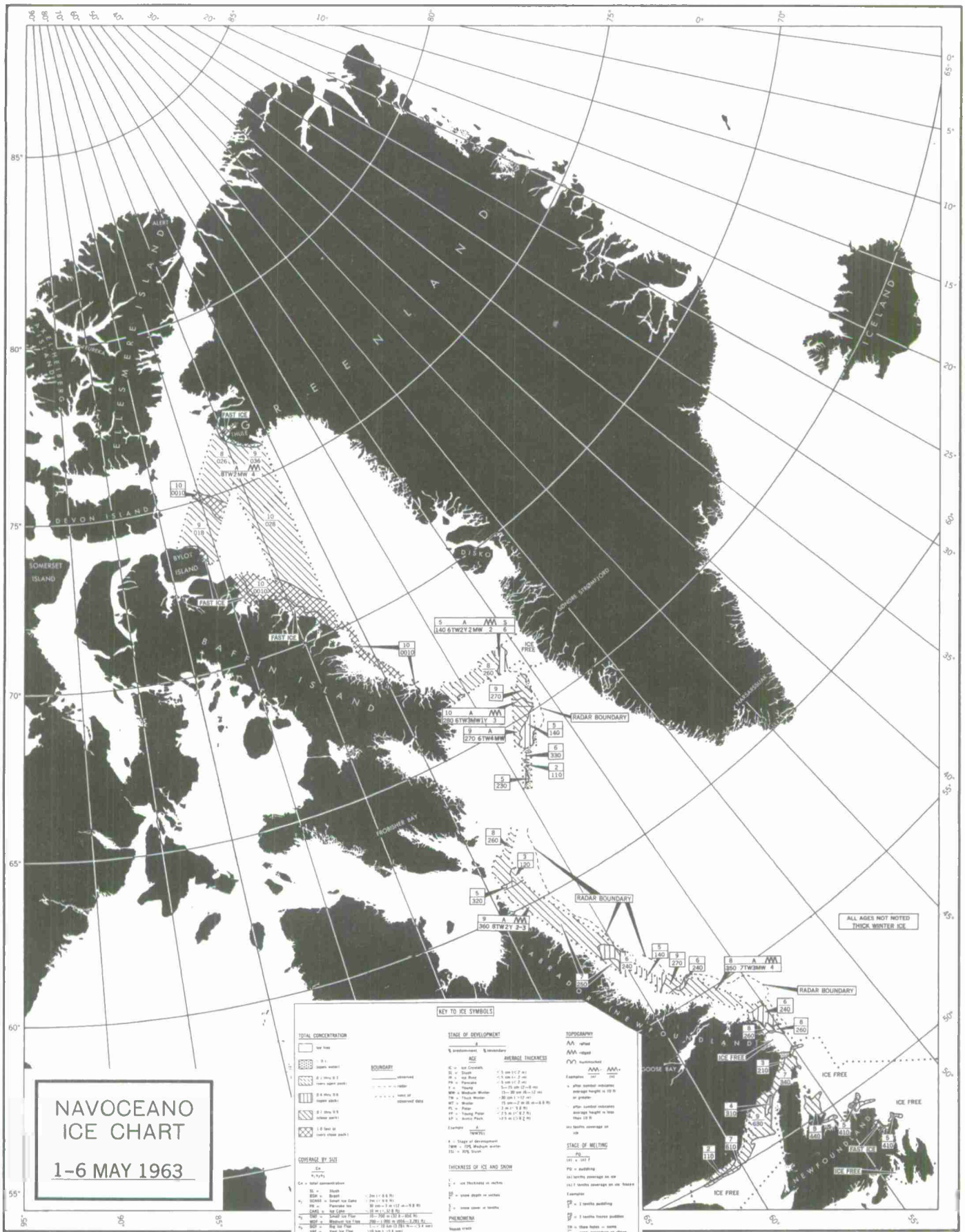
NAVOCEANO ICE CHART

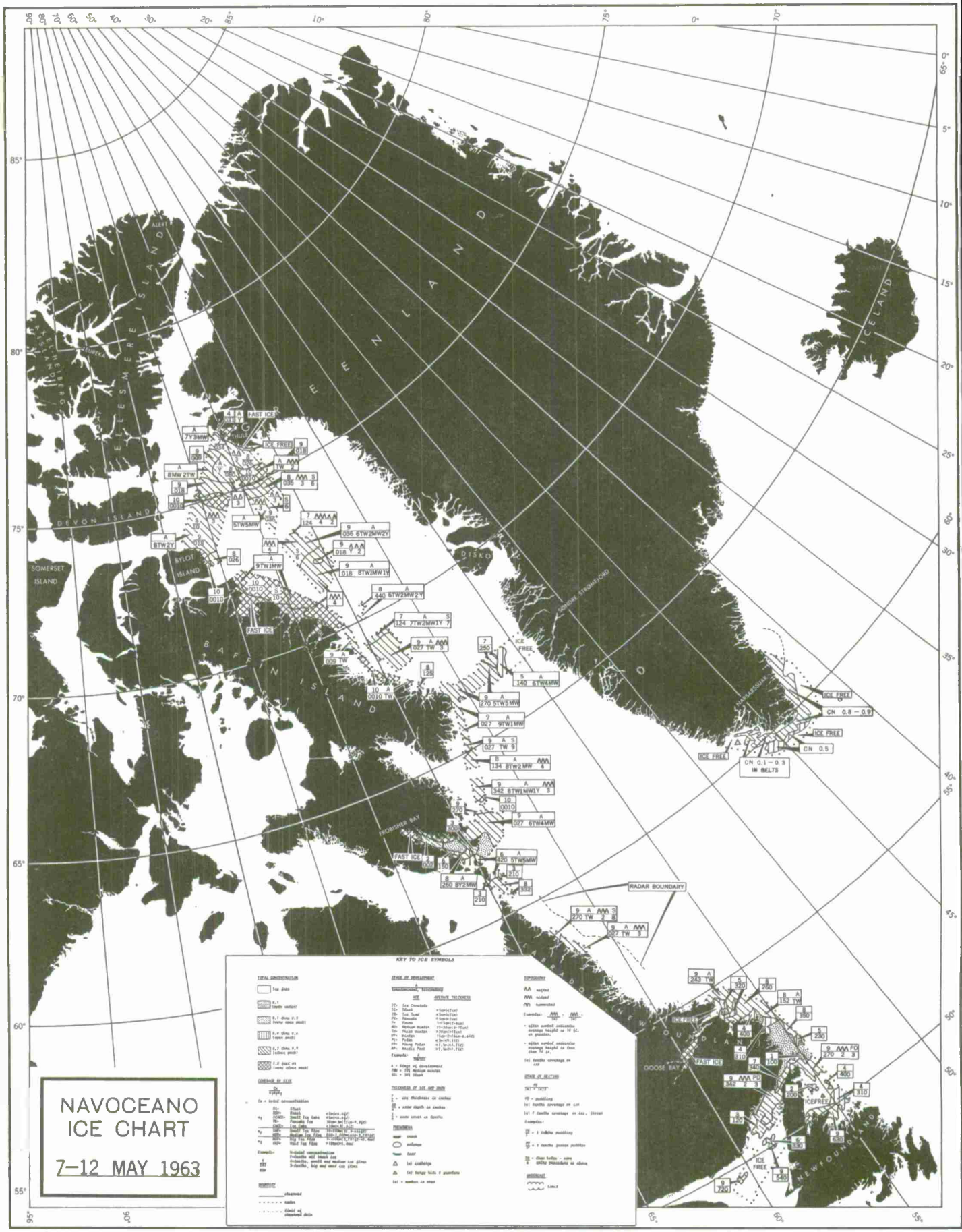
7–12 APRIL 1963

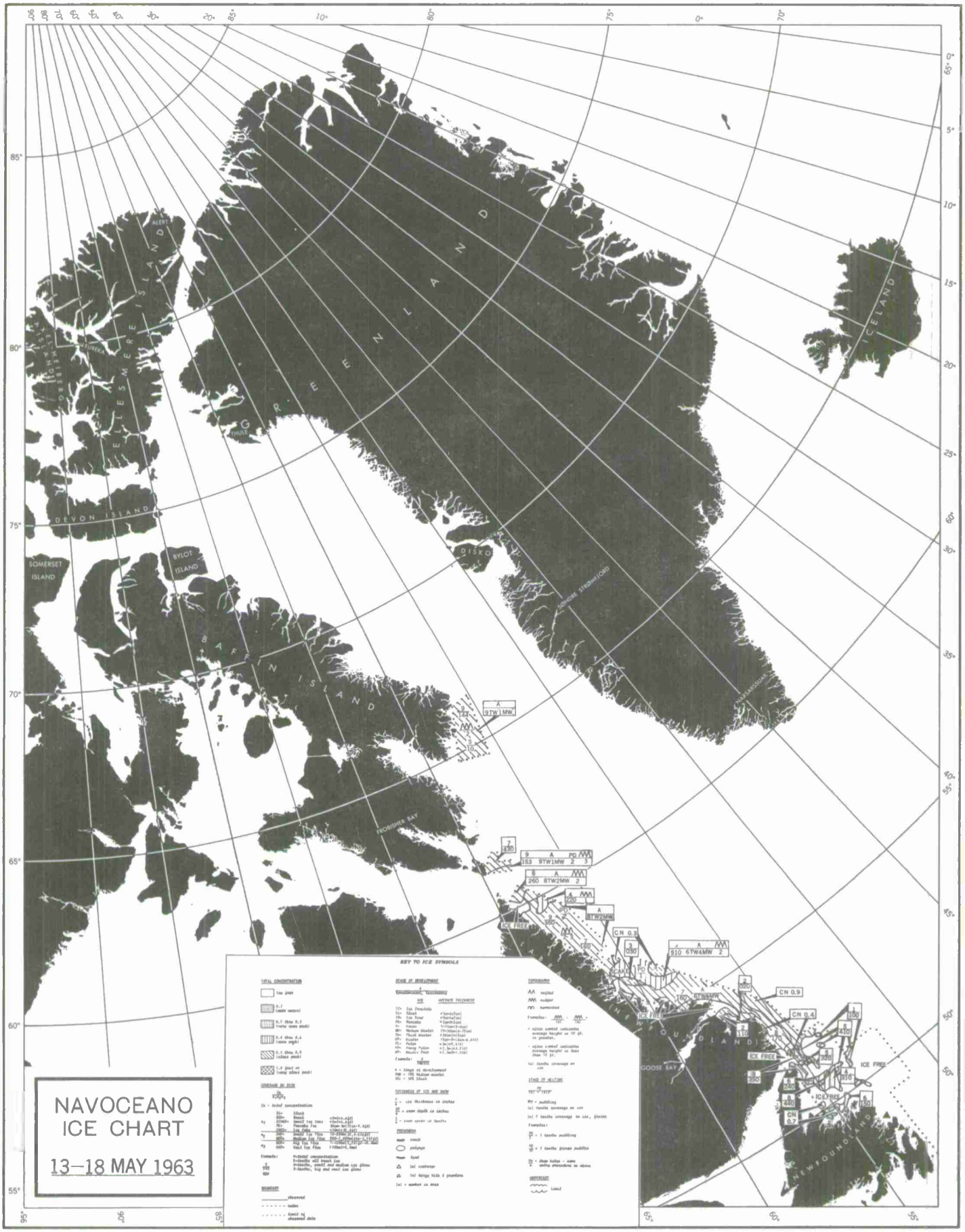

NAVOCEANO
ICE CHART
13-18 APRIL 1963
KEY TO ICE SYMBOLS
ALL AREAS NOT NOTED
A
TW 2-3 1-2
RADAR BOUNDARY
ICE FREE
GREENLAND
ICELAND
BAFFIN ISLAND
DEVON ISLAND
SOMERSET ISLAND
BYLOT ISLAND
ELLESMERE ISLAND
ALBERT
DISKO
LABRADOR
NEWFOUNDLAND
GOOSE BAY
FROBISHER BAY
CN 0.9
CN 0.4
CN 0.8

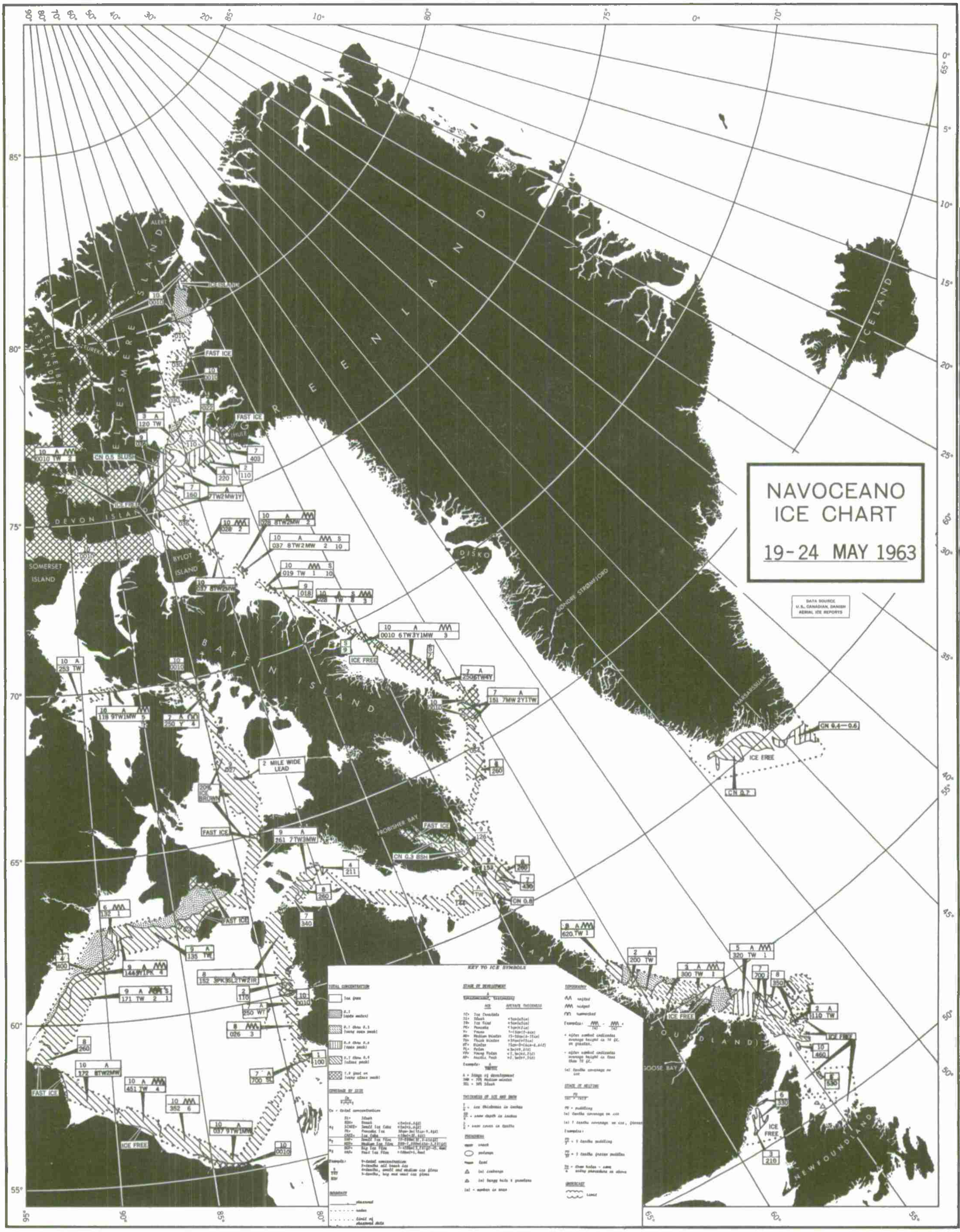

NAVOCEANO
ICE CHART
19-24 APRIL 1963
KEY TO ICE SYMBOLS
TOTAL CONCENTRATION
COVERAGE BY SIZE
STAGE OF DEVELOPMENT
AVERAGE THICKNESS
TOPOGRAPHY
STAGE OF MELTING
THICKNESS OF ICE AND SNOW
PHENOMENA
BOUNDARY
OPENWATER
RADAR BOUNDARY
ICE FREE
FAST ICE
THULE
DISKO
DEVON ISLAND
SOMERSET ISLAND
BYLOT ISLAND
BAFFIN ISLAND
ELLESMERE ISLAND
GREENLAND
ICELAND
NEWFOUNDLAND
LABRADOR
FROBISHER BAY
JAKOBSHAVN ISTRÖMSFJORD

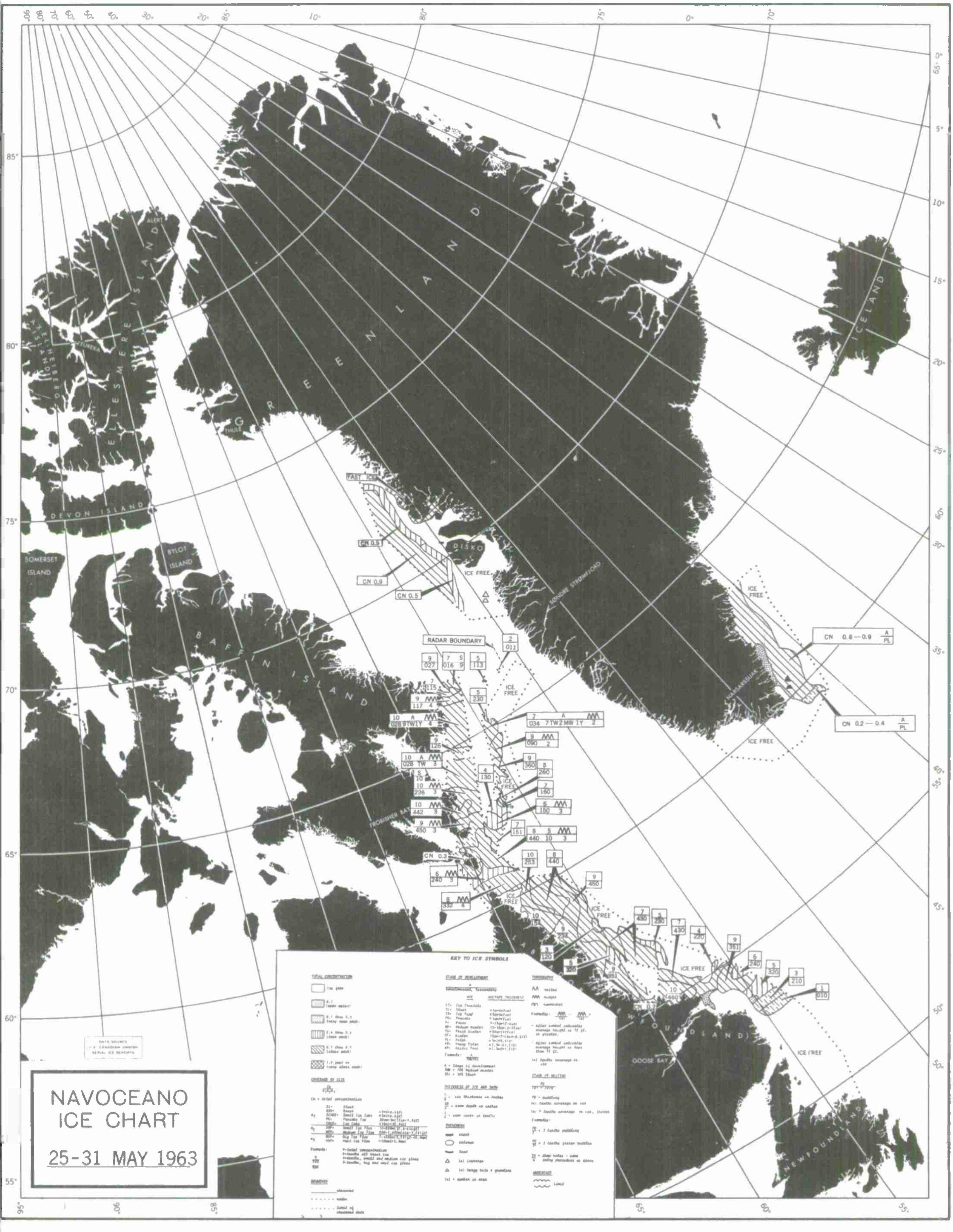

NAVOCEANO
ICE CHART
25-30 APRIL 1963
KEY TO ICE SYMBOLS
GREENLAND
ELLESMERE ISLAND
DEVON ISLAND
SOMERSET ISLAND
BYLOT ISLAND
BAFFIN ISLAND
ICELAND
NEWFOUNDLAND
LABRADOR
DISKO
FROBISHER BAY
FAST ICE
RADAR BOUNDARY
ICE FREE
ALERT
EUREKA
THULE
JAKOBSHAVN
SUKKERTOPPEN (ICE)
ICE
FREE

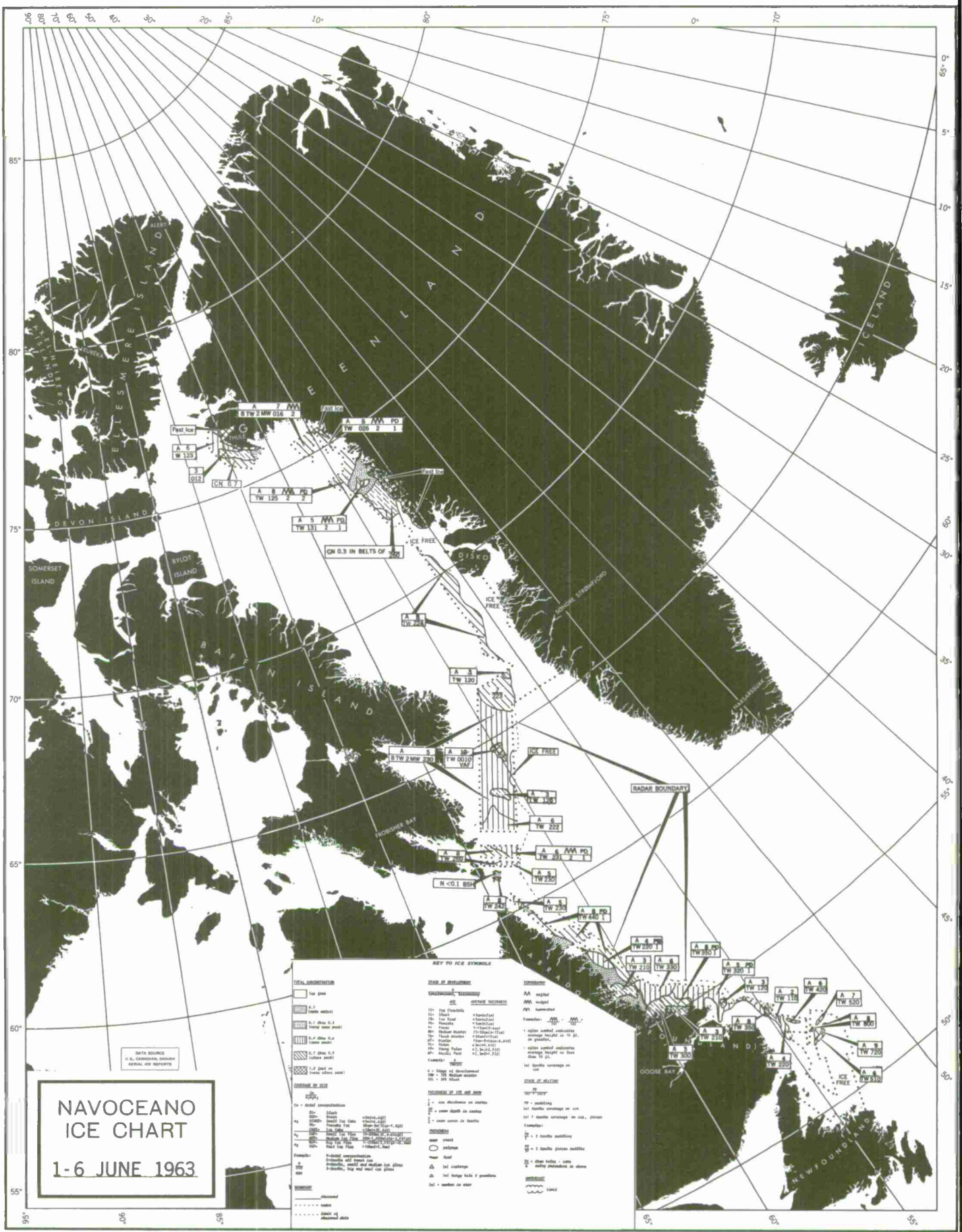

NAVOCEANO
ICE CHART
1-6 MAY 1963
KEY TO ICE SYMBOLS
TOTAL CONCENTRATION
COVERAGE BY SIZE
STAGE OF DEVELOPMENT
AVERAGE THICKNESS
BOUNDARY
TOPOGRAPHY
STAGE OF MELTING
THICKNESS OF ICE AND SNOW
PHENOMENA
UNDERCAST
ALL AGES NOT NOTED THICK WINTER ICE
RADAR BOUNDARY
FAST ICE
ICE FREE
GREENLAND
ELLESMERE ISLAND
DEVON ISLAND
SOMERSET ISLAND
BYLOT ISLAND
BAFFIN ISLAND
ICELAND
NEWFOUNDLAND
LABRADOR
GOOSE BAY
FROBISHER BAY
DISKO
ALERT
THULE

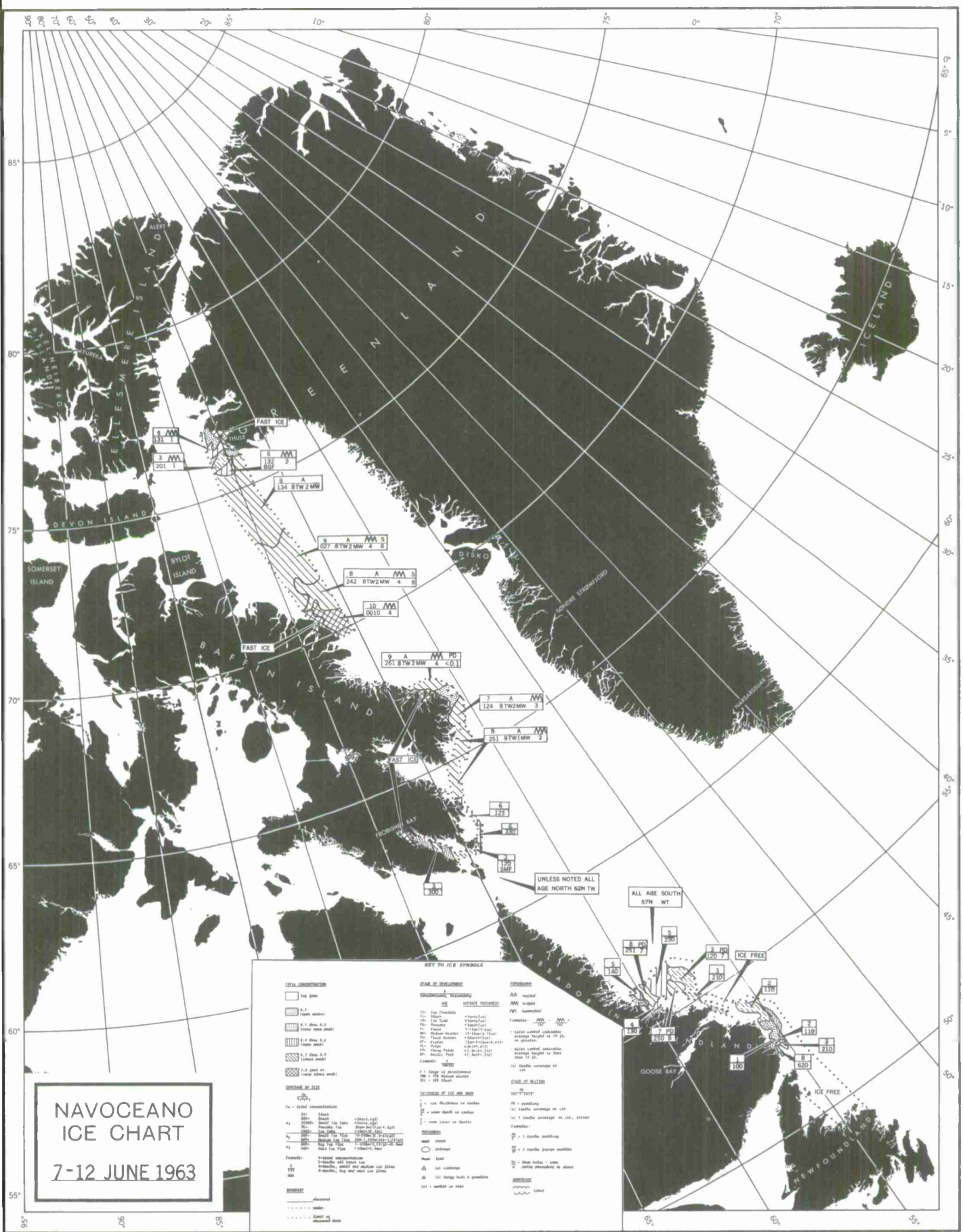

NAVOCEANO
ICE CHART
7–12 MAY 1963
KEY TO ICE SYMBOLS
ELLESMERE ISLAND
ALERT
EUREKA
DEVON ISLAND
SOMERSET ISLAND
BYLOT ISLAND
BAFFIN ISLAND
GREENLAND
DISKO
SØNDRE STRØMFJORD
ICELAND
FROBISHER BAY
FAST ICE
ICE FREE
RADAR BOUNDARY
LABRADOR
NEWFOUNDLAND
GOOSE BAY
ICEFREE
ICE FREE

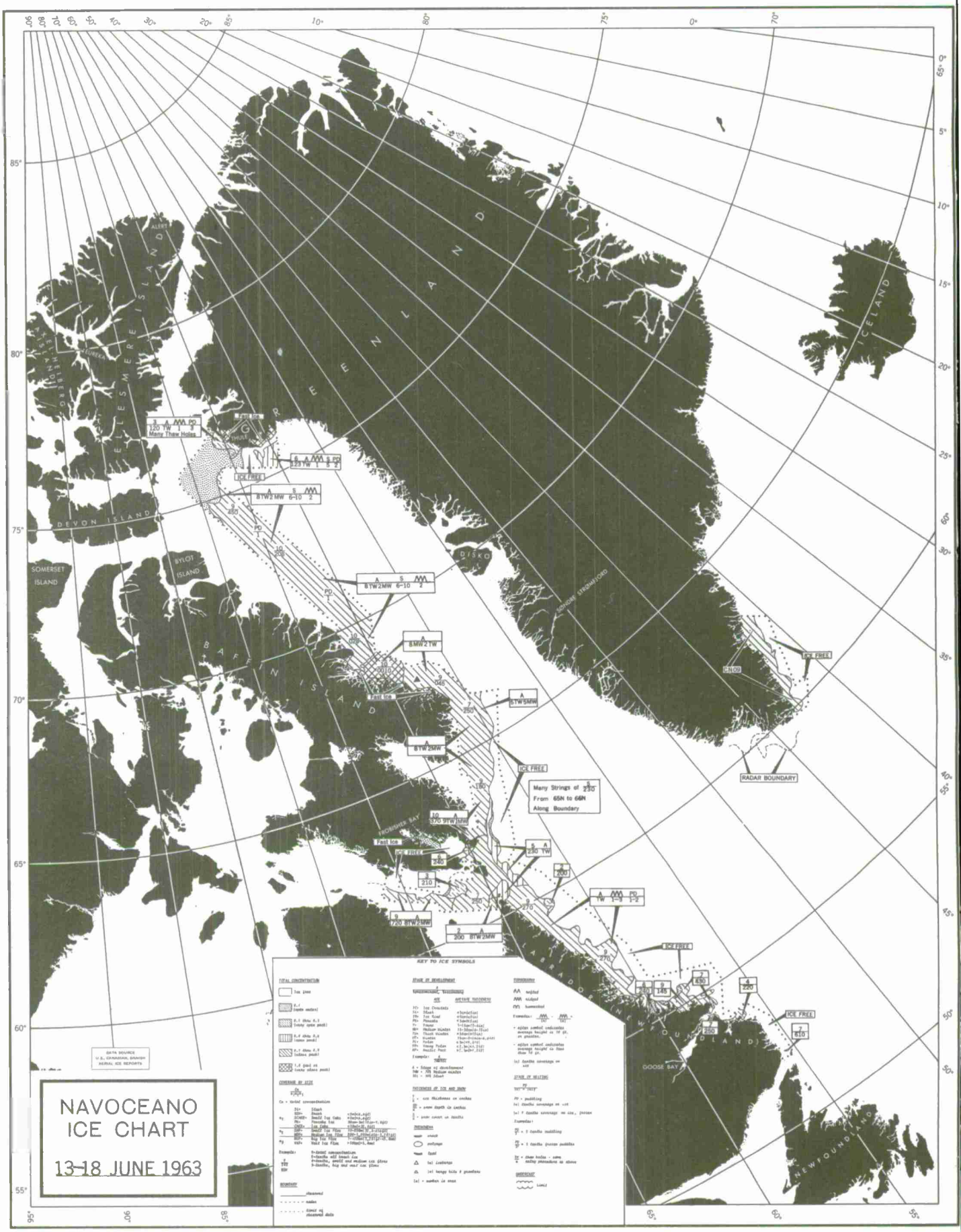

GREENLAND
ELLESMERE ISLAND
DEVON ISLAND
SOMERSET ISLAND
BYLOT ISLAND
BAFFIN ISLAND
ICELAND
ALERT
EUREKA
THULE
DISKO
DAVIS STRAIT
LABRADOR SEA
FROBISHER BAY
NEWFOUNDLAND
GOOSE BAY
ICE FREE
KEY TO ICE SYMBOLS
NAVOCEANO ICE CHART
13–18 MAY 1963

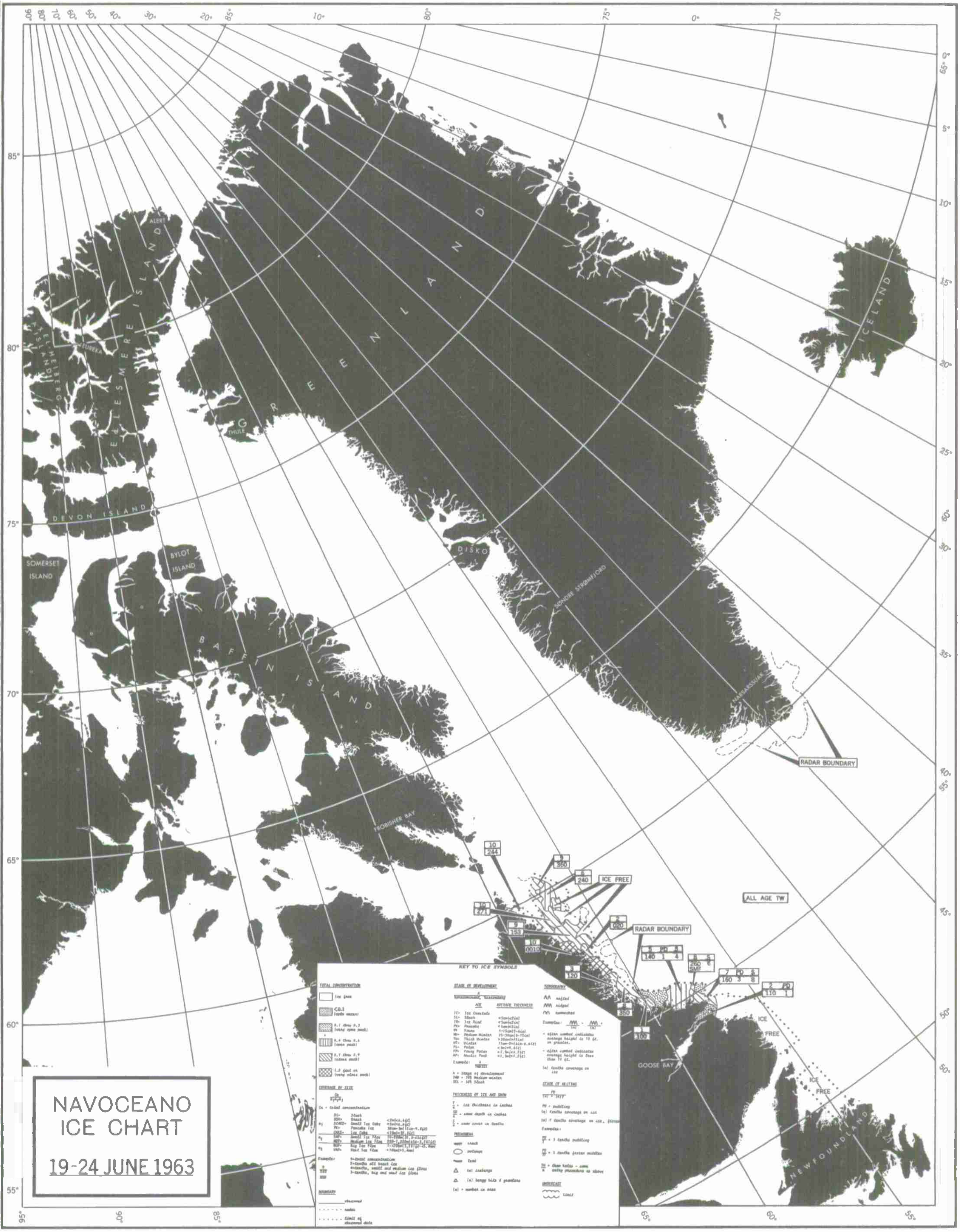

NAVOCEANO
ICE CHART
19-24 MAY 1963
DATA SOURCE
U.S., CANADIAN, DANISH
AERIAL ICE REPORTS
G R E E N L A N D
I C E L A N D
E L L E S M E R E   I S L A N D
AXEL HEIBERG ISLAND
DEVON ISLAND
SOMERSET ISLAND
BYLOT ISLAND
B A F F I N   I S L A N D
DISKO
SONDRE STROMFJORD
NARSARSSUAK
ALERT
EUREKA
THULE
FROBISHER BAY
GOOSE BAY
NEWFOUNDLAND
FAST ICE
ICE FREE
ICE ISLAND
2 MILE WIDE LEAD
KEY TO ICE SYMBOLS

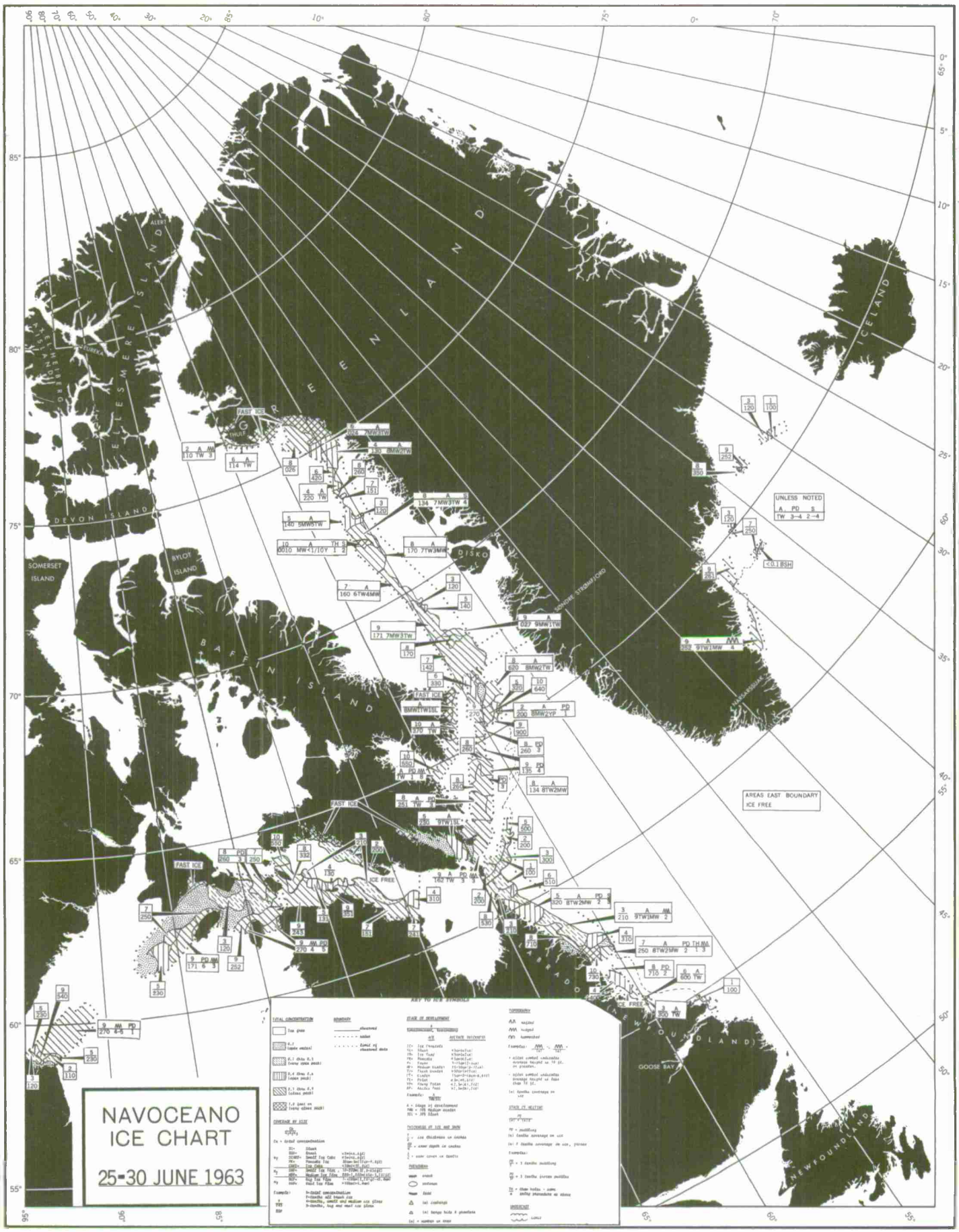

NAVOCEANO
ICE CHART
25-31 MAY 1963
GREENLAND
ICELAND
ELLESMERE ISLAND
AXEL HEIBERG ISLAND
EUREKA
ALERT
THULE
DEVON ISLAND
SOMERSET ISLAND
BYLOT ISLAND
BAFFIN ISLAND
FROBISHER BAY
DISKO
SONDRE STROMFJORD
NARSARSSUAK
GOOSE BAY
NEWFOUNDLAND
FAST ICE
ICE FREE
RADAR BOUNDARY
CN 0.5
CN 0.9
CN 0.3
CN 0.8 — 0.9
CN 0.2 — 0.4
KEY TO ICE SYMBOLS

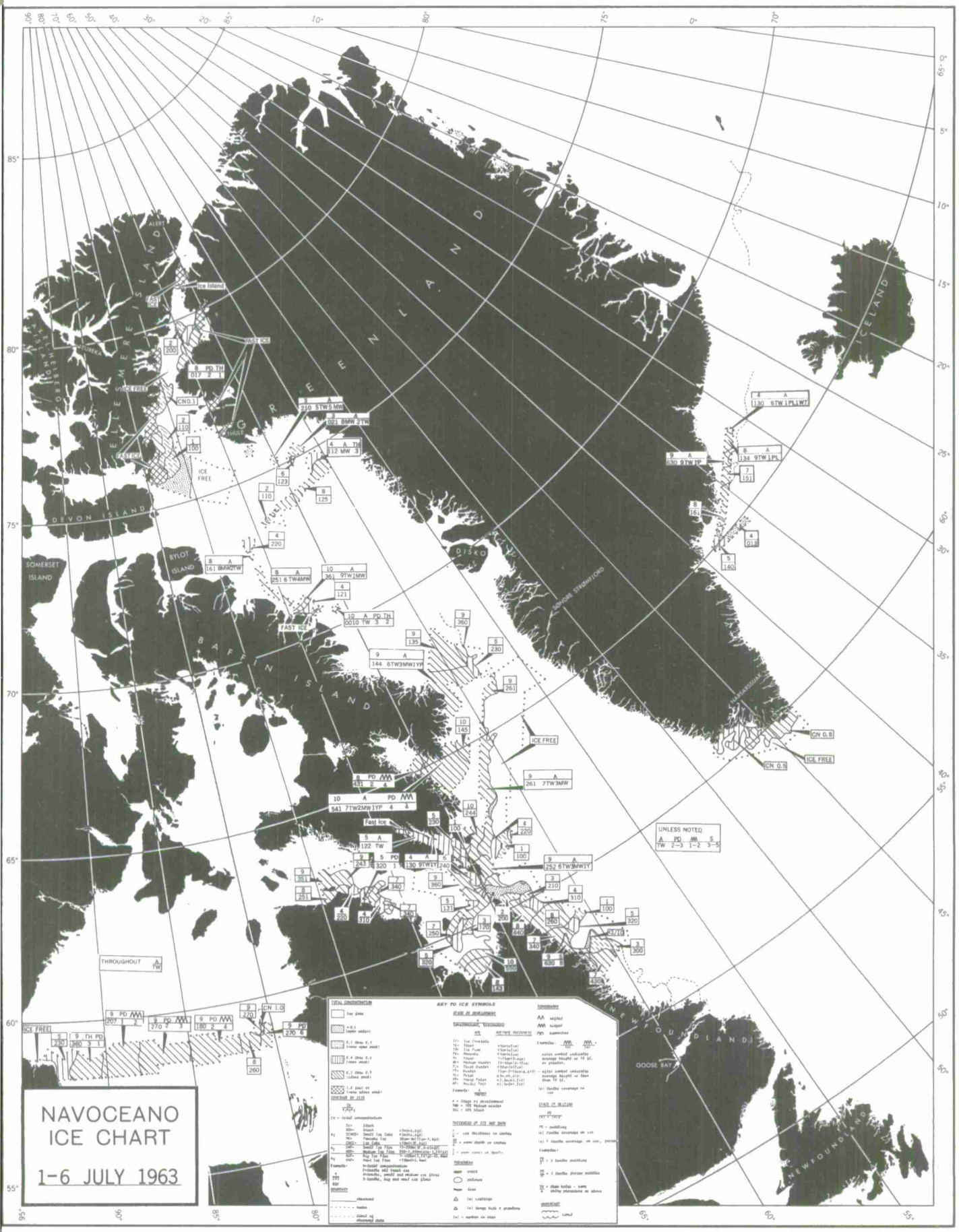

NAVOCEANO
ICE CHART
1-6 JUNE 1963
GREENLAND
ELLESMERE ISLAND
DEVON ISLAND
SOMERSET ISLAND
BYLOT ISLAND
BAFFIN ISLAND
ICELAND
NEWFOUNDLAND
LABRADOR
DISKO
SONDRE STROMFJORD
FROBISHER BAY
GOOSE BAY
RADAR BOUNDARY
ICE FREE
Fast Ice
THULE
EUREKA
ALERT
KEY TO ICE SYMBOLS
DATA SOURCE
U.S., CANADIAN, DANISH
AERIAL ICE REPORTS

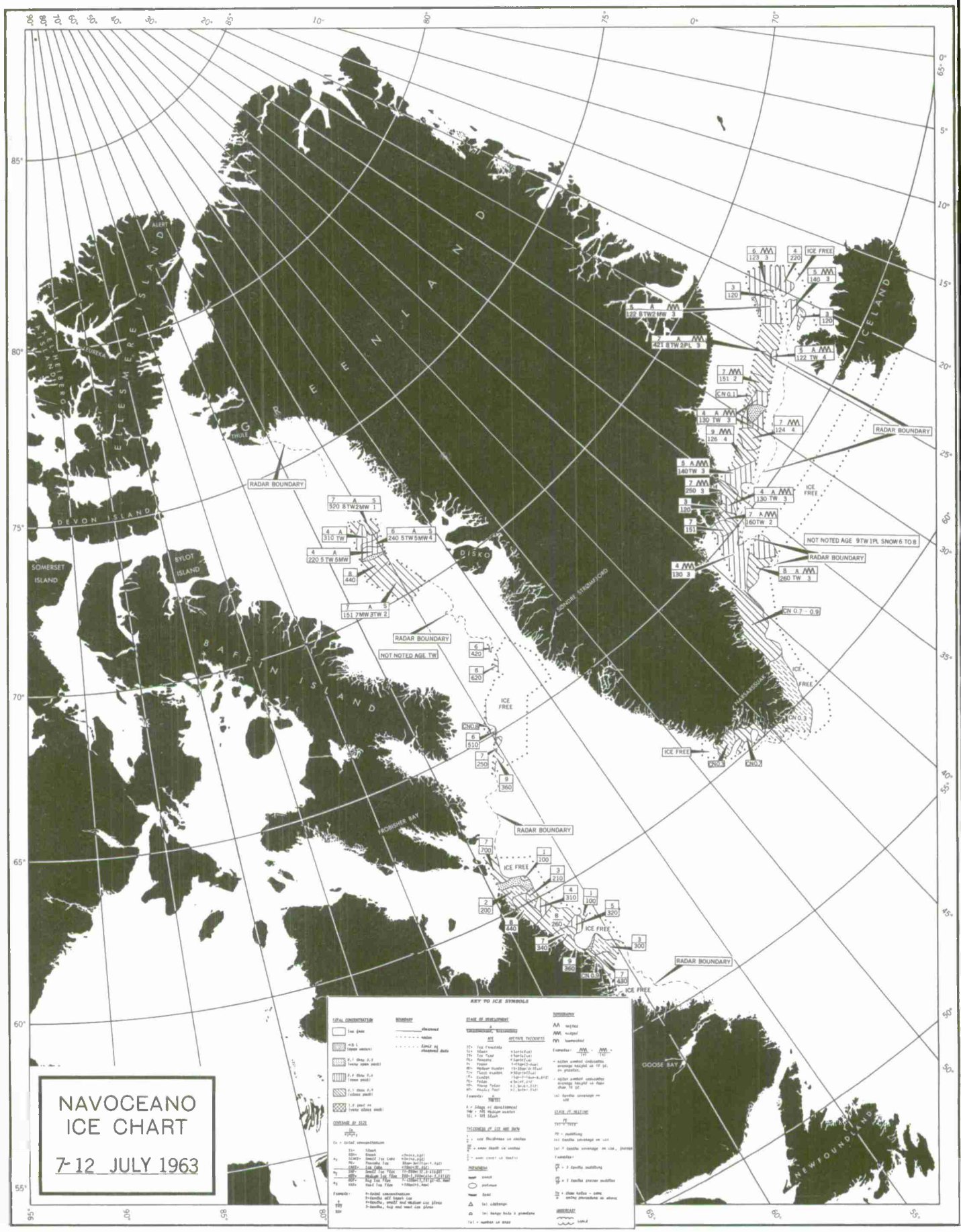

NAVOCEANO
ICE CHART
7-12 JUNE 1963
KEY TO ICE SYMBOLS
ELLESMERE ISLAND
DEVON ISLAND
SOMERSET ISLAND
BYLOT ISLAND
BAFFIN ISLAND
GREENLAND
ICELAND
NEWFOUNDLAND
LABRADOR
THULE
DISKO
GODTHAB
FROBISHER BAY
GOOSE BAY
FAST ICE
ICE FREE
UNLESS NOTED ALL AGE NORTH 62N TW
ALL AGE SOUTH 57N WT

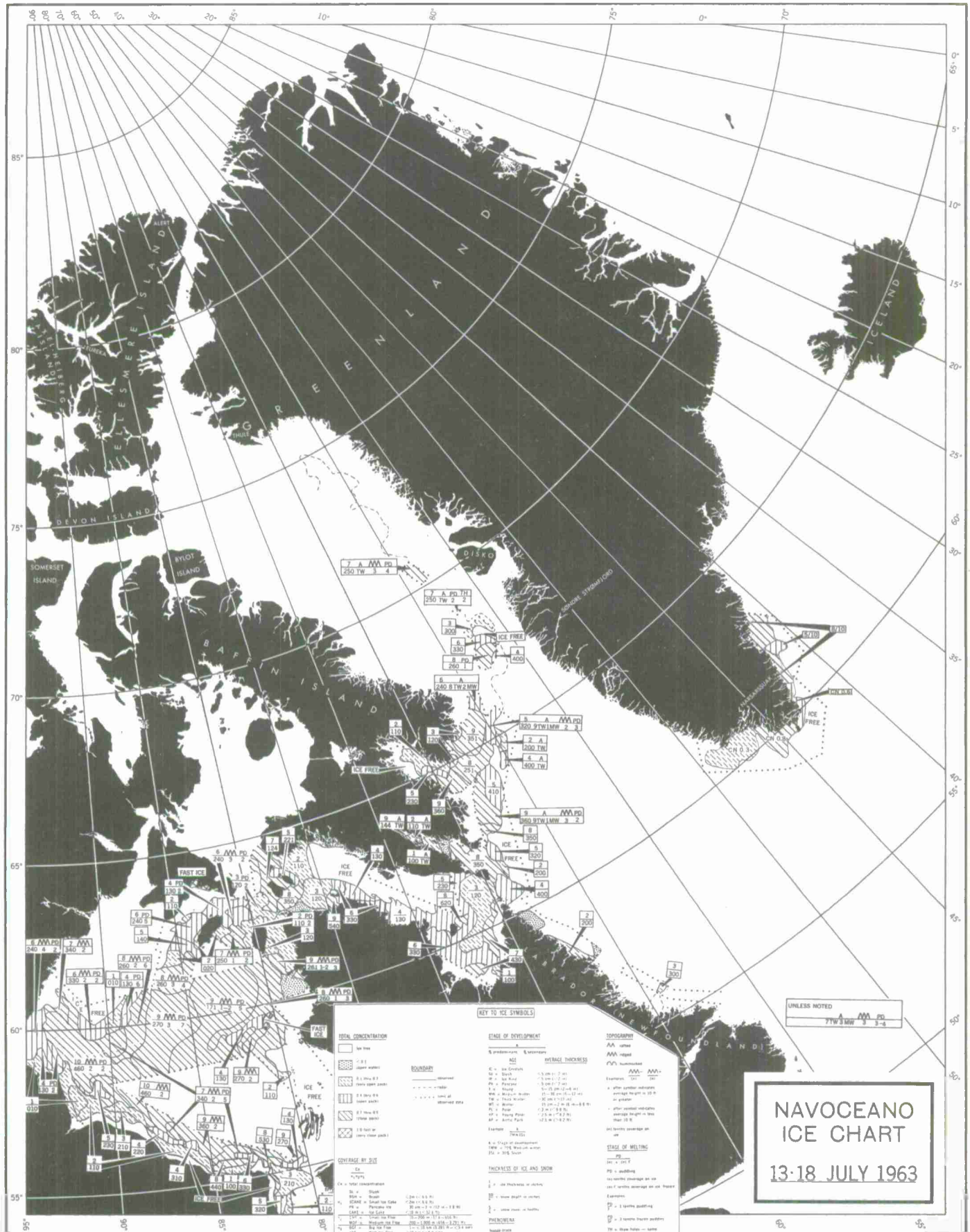

NAVOCEANO
ICE CHART
13-18 JUNE 1963
DATA SOURCE
U.S., CANADIAN, DANISH
AERIAL ICE REPORTS
KEY TO ICE SYMBOLS
GREENLAND
ELLESMERE ISLAND
DEVON ISLAND
SOMERSET ISLAND
BYLOT ISLAND
BAFFIN ISLAND
ICELAND
NEWFOUNDLAND
LABRADOR
ALERT
THULE
EUREKA
RESOLUTE
DISKO
GOOSE BAY
Many Thaw Holes
Many Strings of 9/230
From 65N to 66N
Along Boundary
RADAR BOUNDARY
ICE FREE
Fast Ice
PD
DANMARK STRAIT/ORD

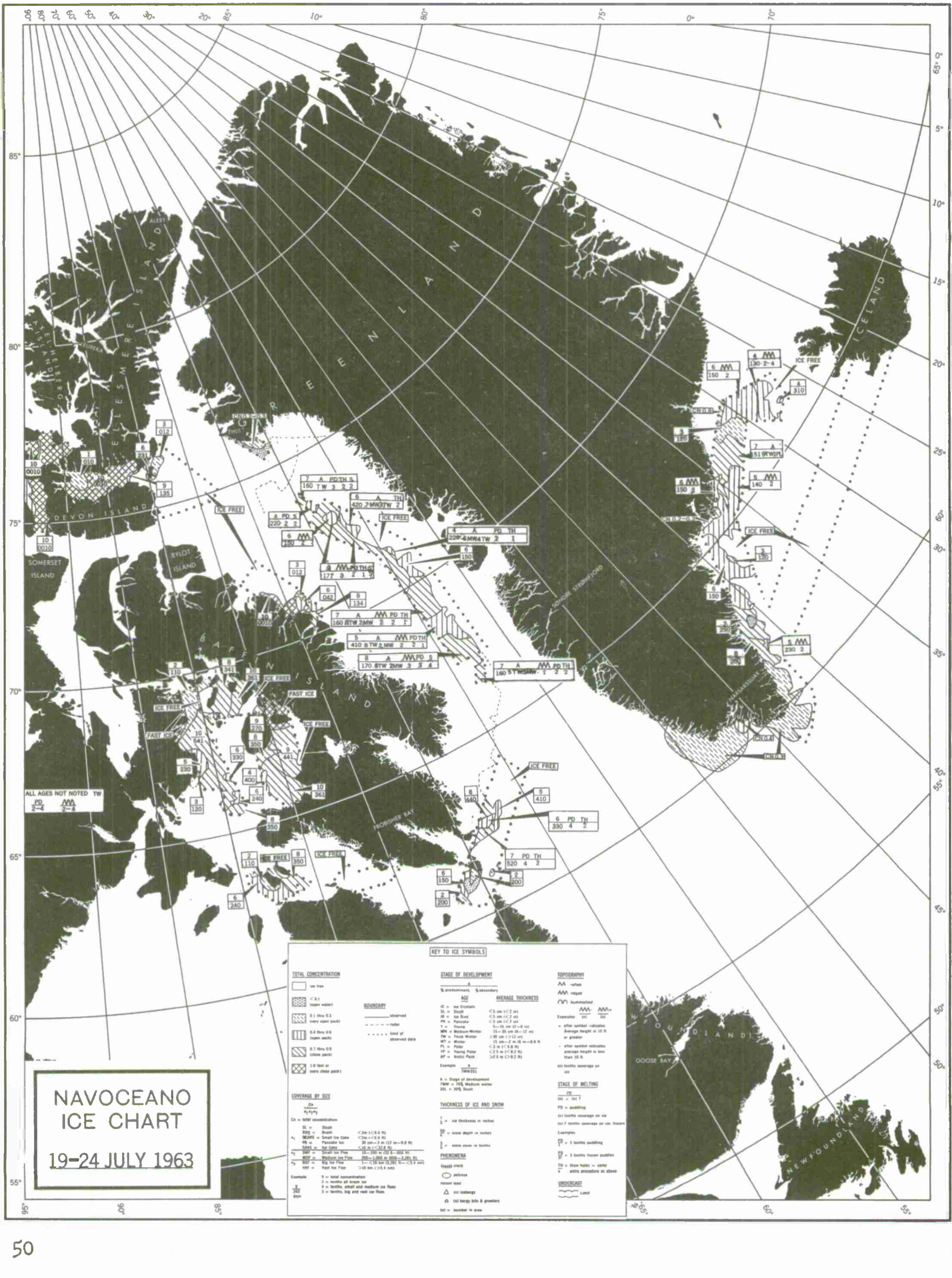

NAVOCEANO
ICE CHART
19-24 JUNE 1963
GREENLAND
ICELAND
ELLESMERE ISLAND
AXEL HEIBERG ISLAND
ALERT
EUREKA
THULE
DEVON ISLAND
SOMERSET ISLAND
BYLOT ISLAND
BAFFIN ISLAND
DISKO
SONDRE STROMFJORD
NARSARSSUAQ
FROBISHER BAY
GOOSE BAY
NEWFOUNDLAND
RADAR BOUNDARY
ICE FREE
ALL AGE TW
KEY TO ICE SYMBOLS

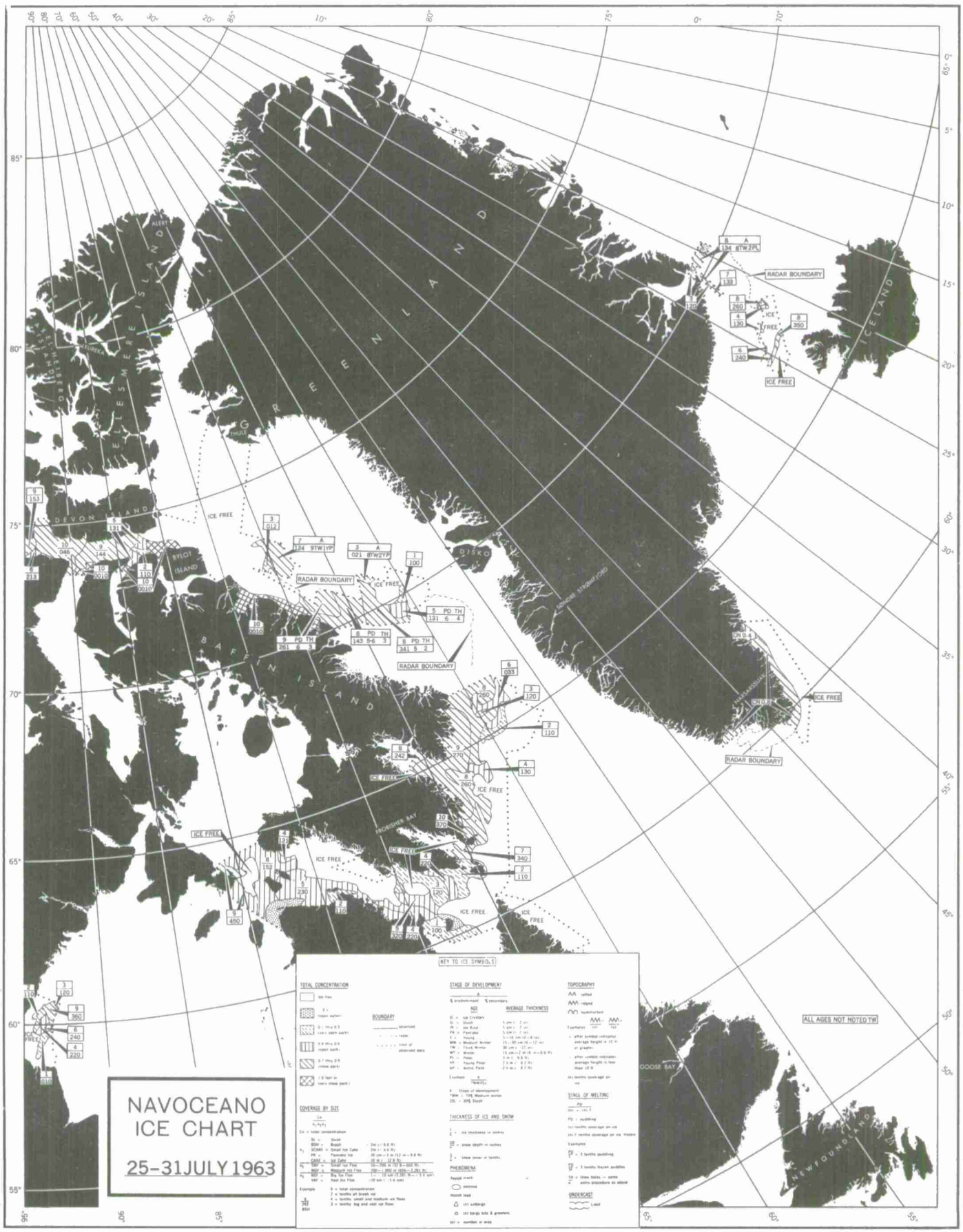

NAVOCEANO
ICE CHART
25-30 JUNE 1963
GREENLAND
ICELAND
ELLESMERE ISLAND
DEVON ISLAND
SOMERSET ISLAND
BYLOT ISLAND
BAFFIN ISLAND
LABRADOR
NEWFOUNDLAND
GOOSE BAY
ALERT
EUREKA
THULE
DISKO
SØNDRE STRØMMFJORD
SUKKERTOPPEN
FAST ICE
ICE FREE
UNLESS NOTED
A PD S
TW 3-4 2-4
<0.1 BSH
AREAS EAST BOUNDARY
ICE FREE
KEY TO ICE SYMBOLS

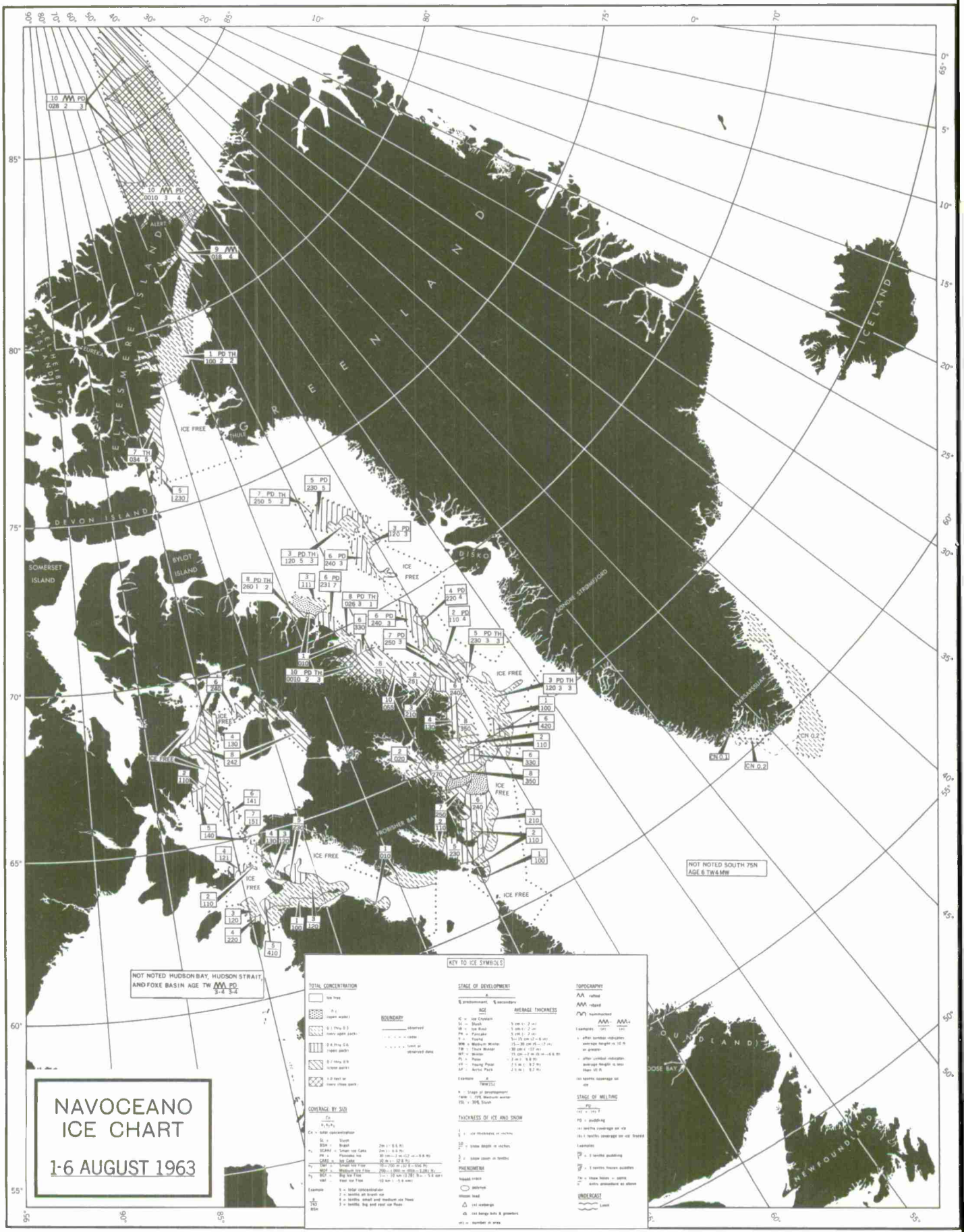

NAVOCEANO
ICE CHART
1-6 JULY 1963
GREENLAND
ELLESMERE ISLAND
DEVON ISLAND
SOMERSET ISLAND
BYLOT ISLAND
BAFFIN ISLAND
ICELAND
NEWFOUNDLAND
LABRADOR
Ice Island
ALERT
EUREKA
THULE
GOOSE BAY
DISKO
FAST ICE
ICE FREE
Fast Ice
THROUGHOUT
UNLESS NOTED
KEY TO ICE SYMBOLS

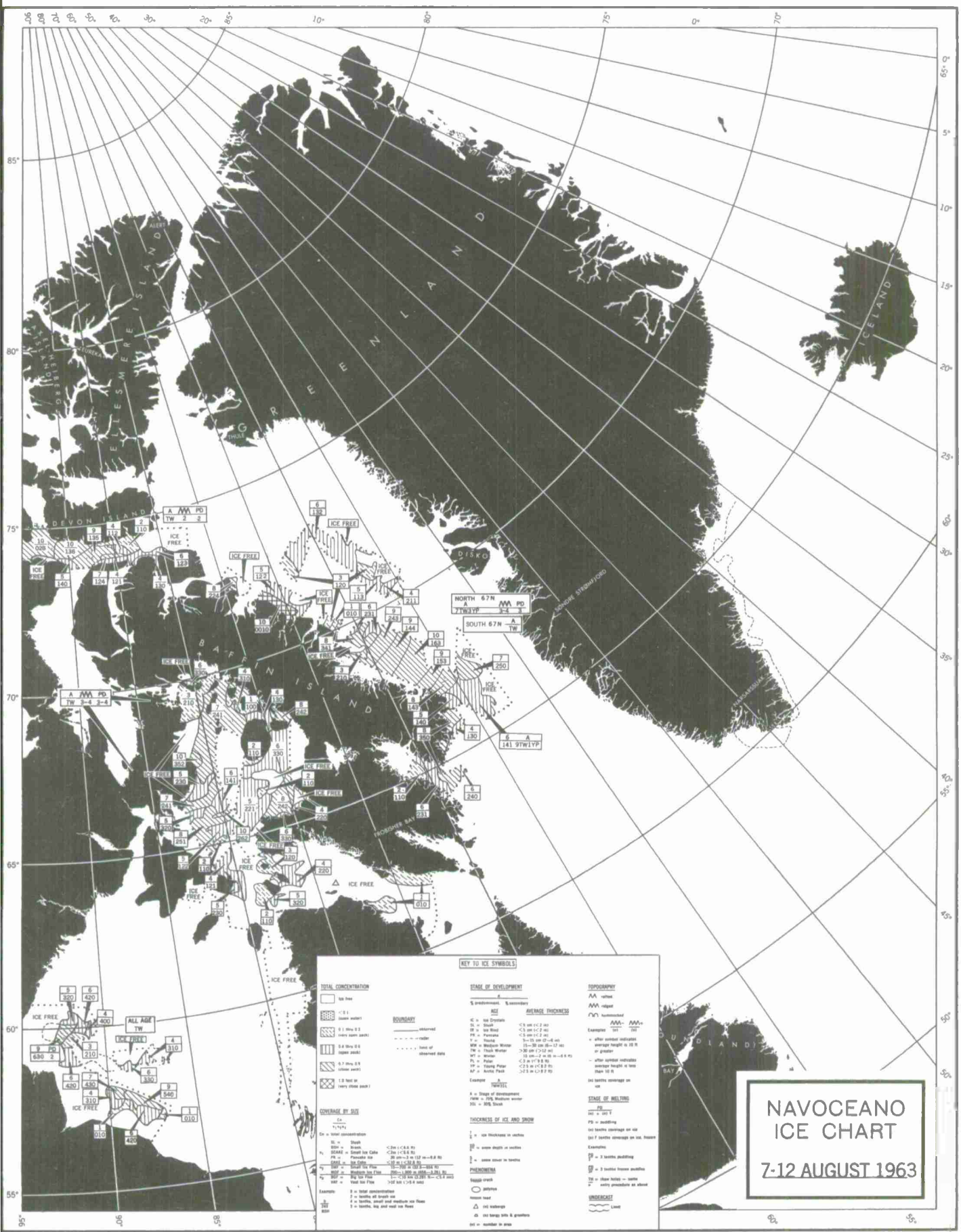

NAVOCEANO
ICE CHART
7-12 JULY 1963
KEY TO ICE SYMBOLS
GREENLAND
ICELAND
ELLESMERE ISLAND
DEVON ISLAND
SOMERSET ISLAND
BYLOT ISLAND
BAFFIN ISLAND
FROBISHER BAY
DISKO
SØNDRE STRØMFJORD
THULE
ALERT
EUREKA
GOOSE BAY
NEWFOUNDLAND
RADAR BOUNDARY
NOT NOTED AGE 9TW 1PL SNOW 6 TO 8
NOT NOTED AGE TW
ICE FREE
CN 0.1
CN 0.3
CN 0.7 - 0.9
CN 0.8
CN 0.9
CN 1.0

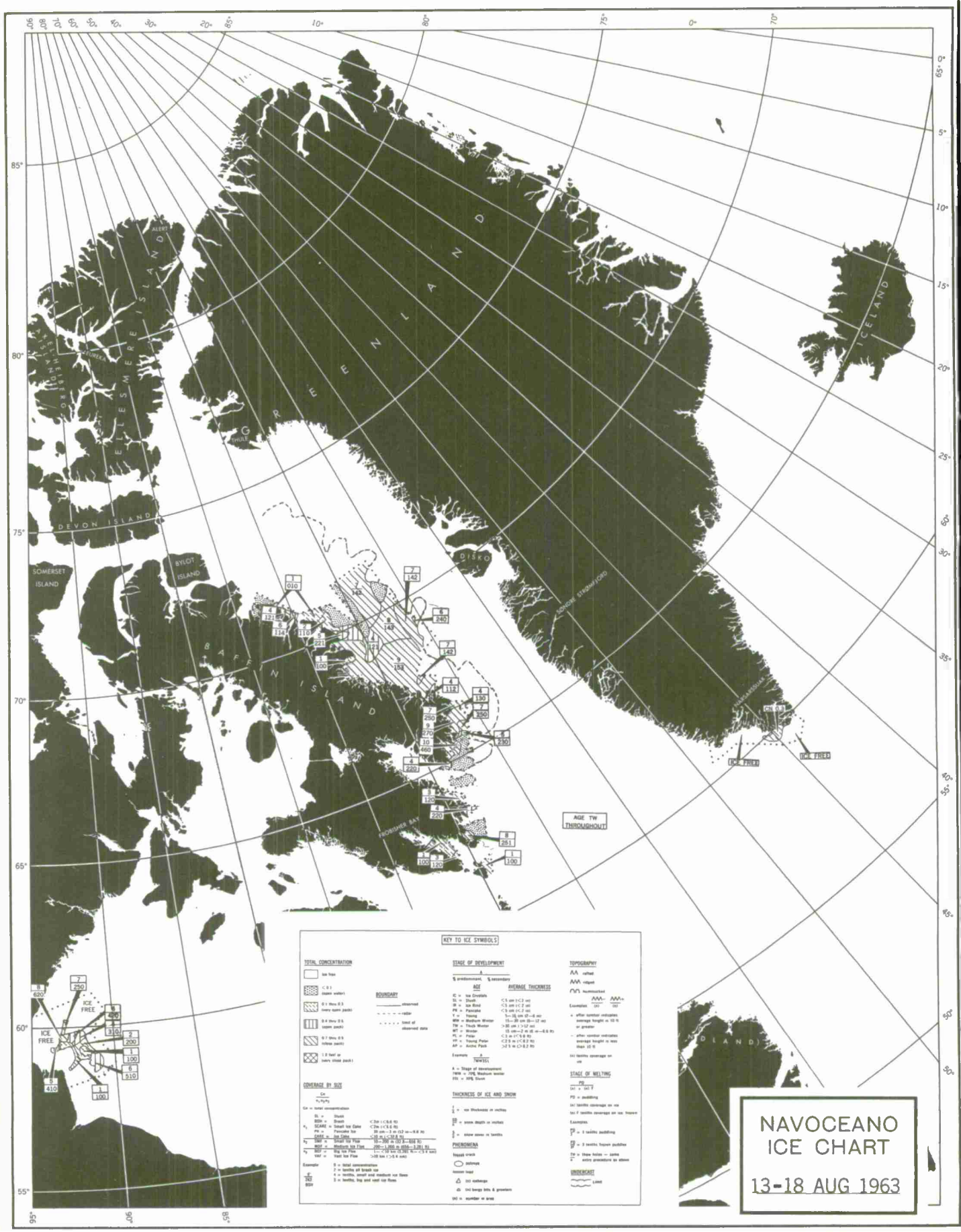

GREENLAND
ICELAND
ELLESMERE ISLAND
DEVON ISLAND
SOMERSET ISLAND
BYLOT ISLAND
BAFFIN ISLAND
ALERT
EUREKA
THULE
DISKO
JAKOBSHAVN
ICE FREE
FAST ICE
LABRADOR
NEWFOUNDLAND
UNLESS NOTED
7 A PD 7TW 3 3-4
NAVOCEANO
ICE CHART
13-18 JULY 1963
KEY TO ICE SYMBOLS
TOTAL CONCENTRATION
BOUNDARY
STAGE OF DEVELOPMENT
AVERAGE THICKNESS
TOPOGRAPHY
COVERAGE BY SIZE
THICKNESS OF ICE AND SNOW
PHENOMENA
UNDERCAST
STAGE OF MELTING


NAVOCEANO
ICE CHART
19–24 JULY 1963
GREENLAND
ICELAND
ELLESMERE ISLAND
AXEL HEIBERG ISLAND
DEVON ISLAND
SOMERSET ISLAND
BYLOT ISLAND
BAFFIN ISLAND
FROBISHER BAY
NEWFOUNDLAND
GOOSE BAY
ALERT
EUREKA
THULE
KEY TO ICE SYMBOLS
ALL AGES NOT NOTED TW


NAVOCEANO
ICE CHART
25-31JULY1963
KEY TO ICE SYMBOLS
TOTAL CONCENTRATION
BOUNDARY
STAGE OF DEVELOPMENT
TOPOGRAPHY
COVERAGE BY SIZE
AGE
AVERAGE THICKNESS
STAGE OF MELTING
THICKNESS OF ICE AND SNOW
PHENOMENA
UNDERCAST
ALL AGES NOT NOTED TW
RADAR BOUNDARY
ICE FREE
GREENLAND
ELLESMERE ISLAND
DEVON ISLAND
BYLOT ISLAND
BAFFIN ISLAND
ICELAND
NEWFOUNDLAND
GOOSE BAY
FROBISHER BAY
THULE
ALERT
EUREKA
DISKO
ANGMAGSSALIK

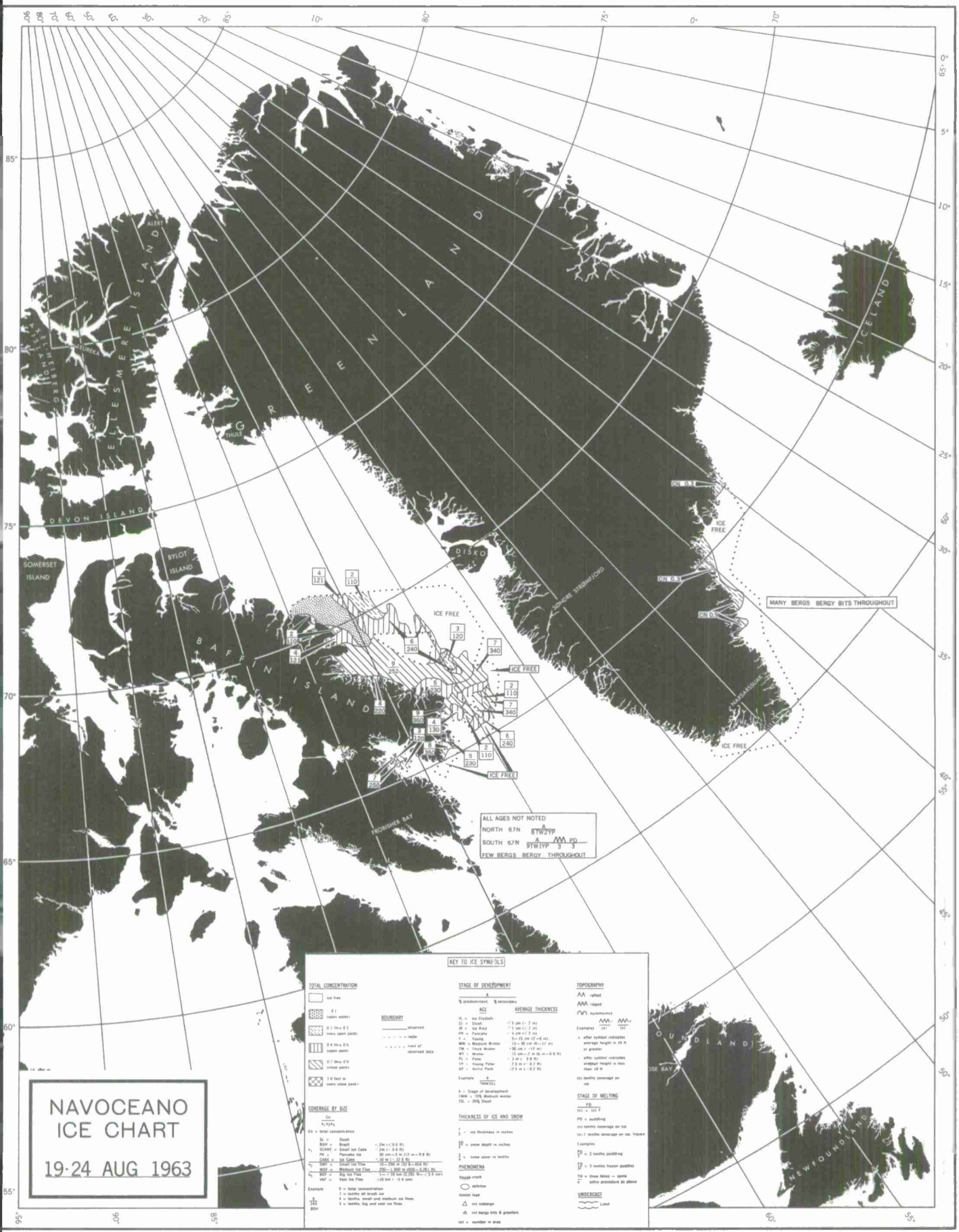

NAVOCEANO
ICE CHART
1-6 AUGUST 1963
KEY TO ICE SYMBOLS
NOT NOTED HUDSON BAY, HUDSON STRAIT, AND FOXE BASIN AGE TW MM PD 3-4 5-2
NOT NOTED SOUTH 75N AGE 6 TW 4 MW
GREENLAND
ICELAND
DEVON ISLAND
SOMERSET ISLAND
ELLESMERE ISLAND
NEWFOUNDLAND
ICE FREE
FROBISHER BAY
DISKO
BYLOT ISLAND
ALERT
EUREKA
THULE
GODTHAB
JULIANEHAB
GODHAVN
UMANAKFJORD
CN 0.1
CN 0.2

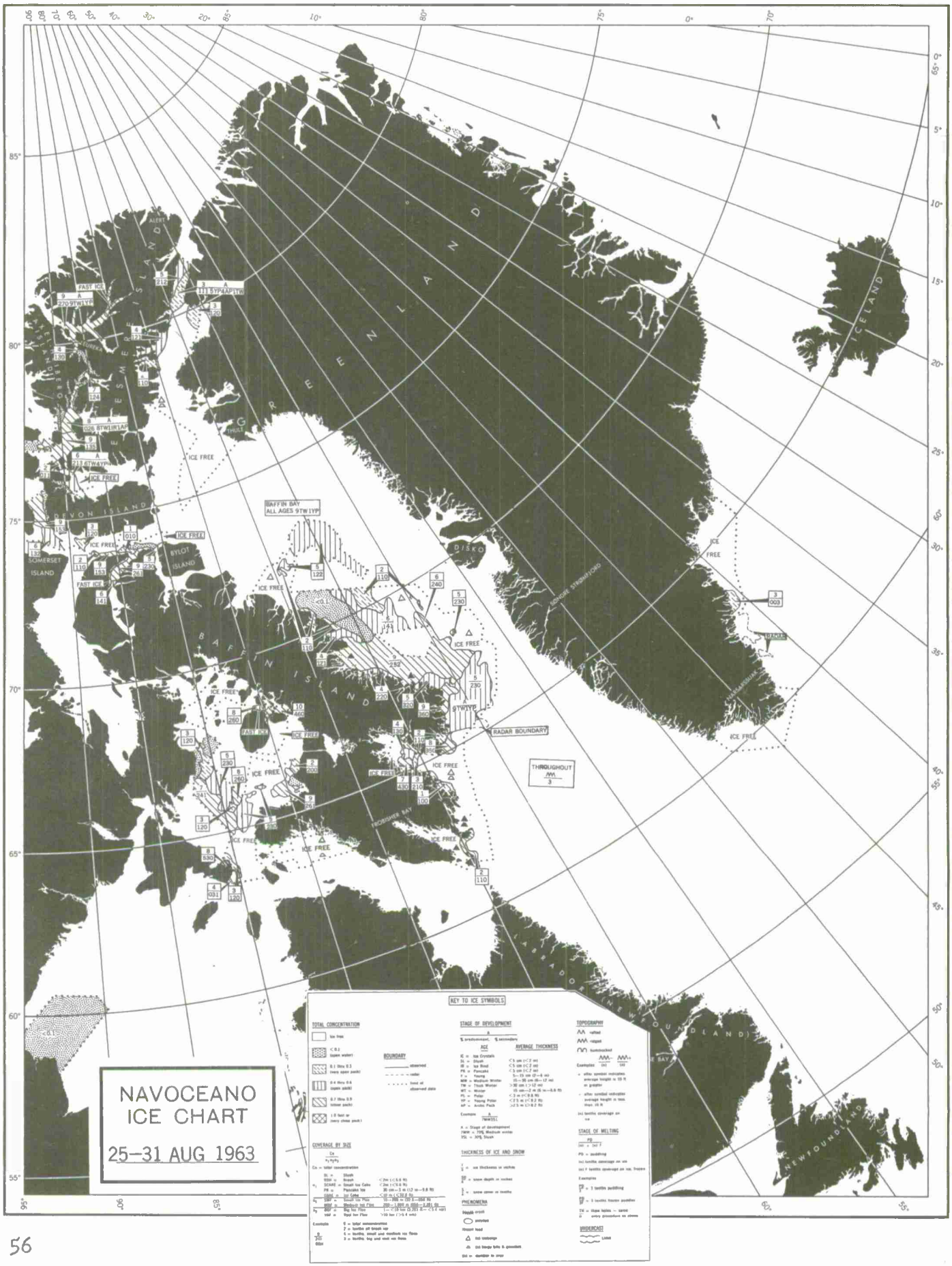

KEY TO ICE SYMBOLS
TOTAL CONCENTRATION
BOUNDARY
STAGE OF DEVELOPMENT
AGE
AVERAGE THICKNESS
TOPOGRAPHY
COVERAGE BY SIZE
THICKNESS OF ICE AND SNOW
PHENOMENA
STAGE OF MELTING
UNDERCAST
NAVOCEANO
ICE CHART
7-12 AUGUST 1963
NORTH 67N
SOUTH 67N
ICE FREE
ALL AGE
BAFFIN ISLAND
GREENLAND
ICELAND
DISKO
THULE
ALERT
EUREKA
DEVON ISLAND
FROBISHER BAY

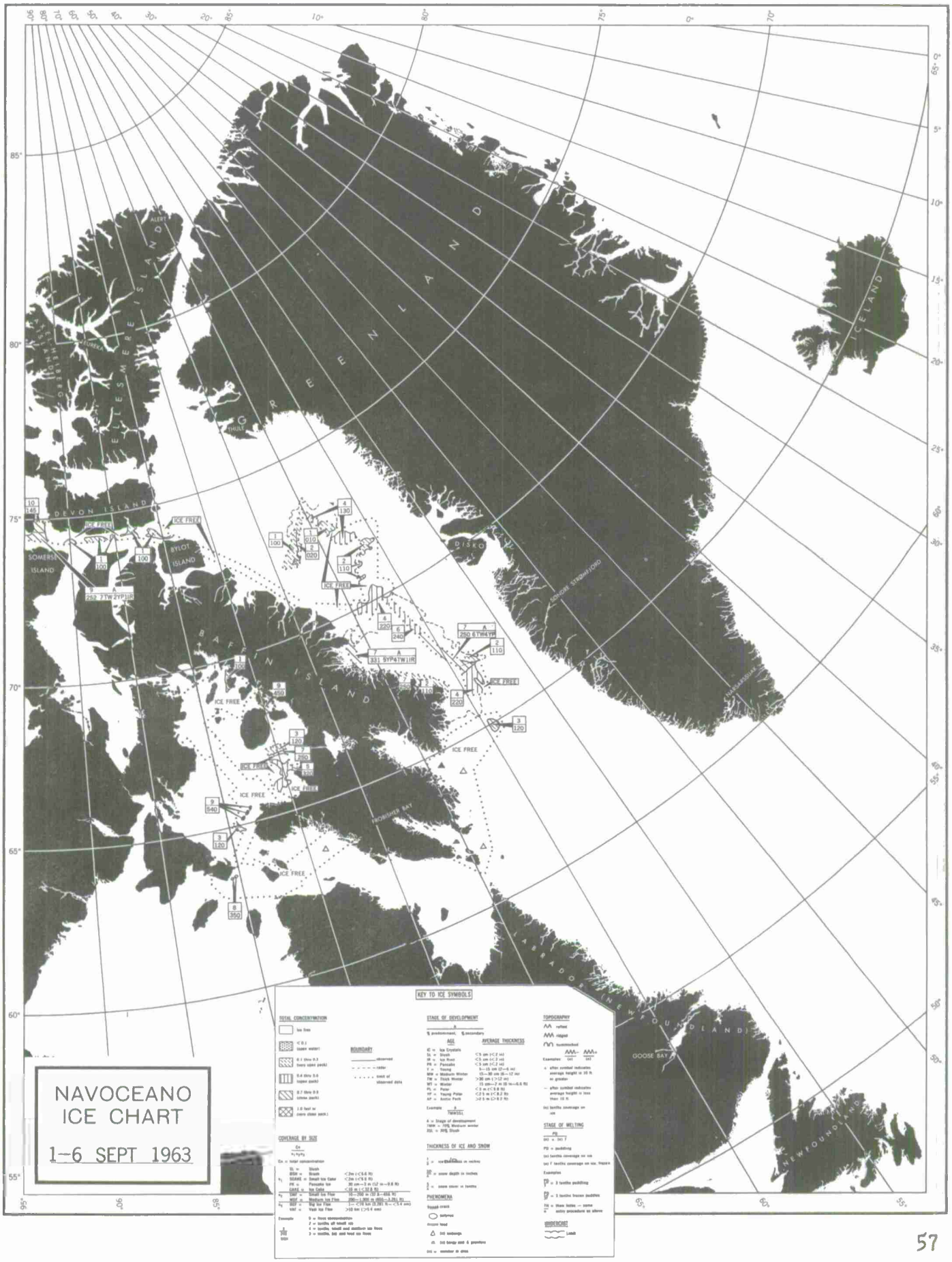


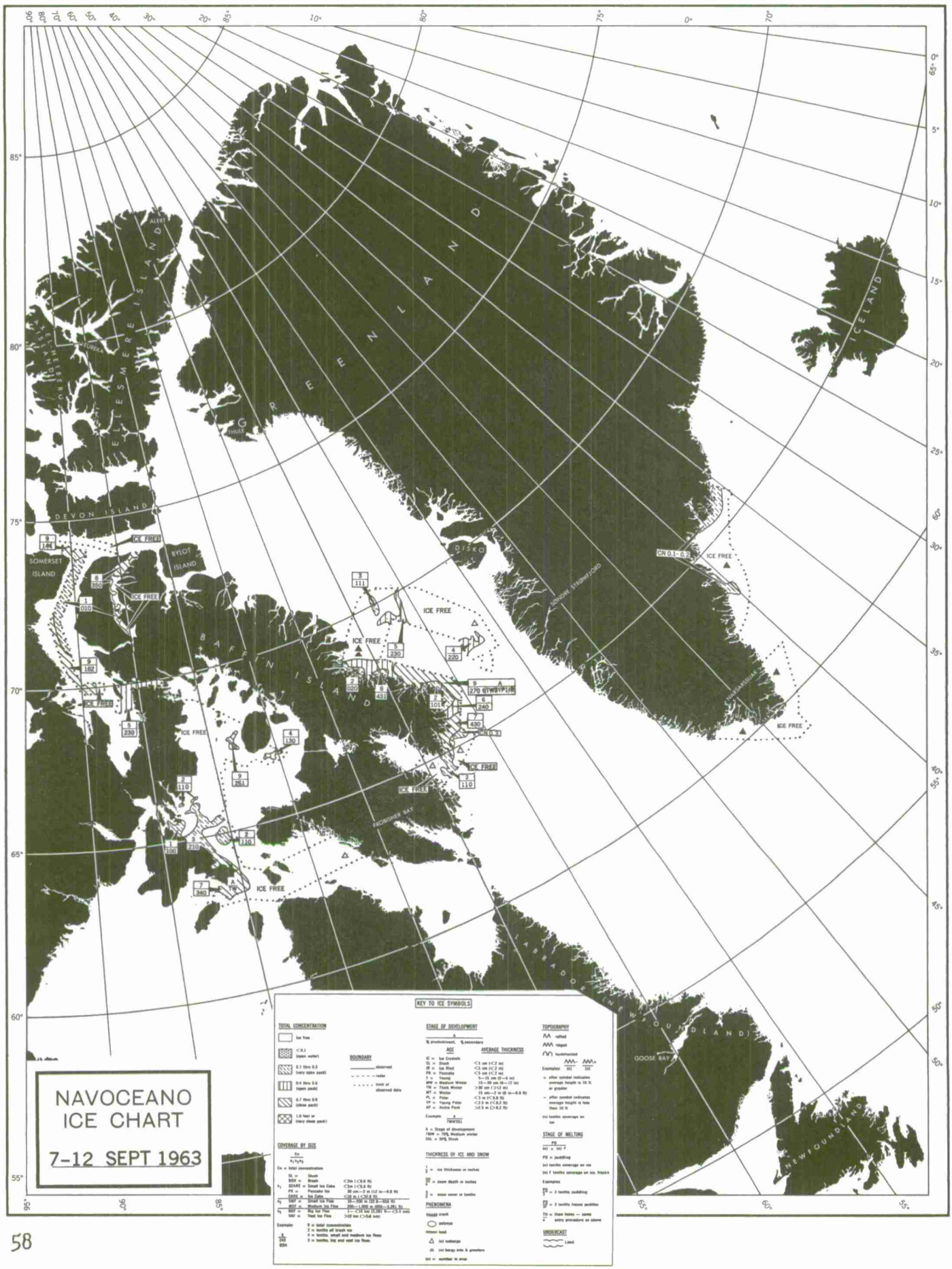
NAVOCEANO ICE CHART

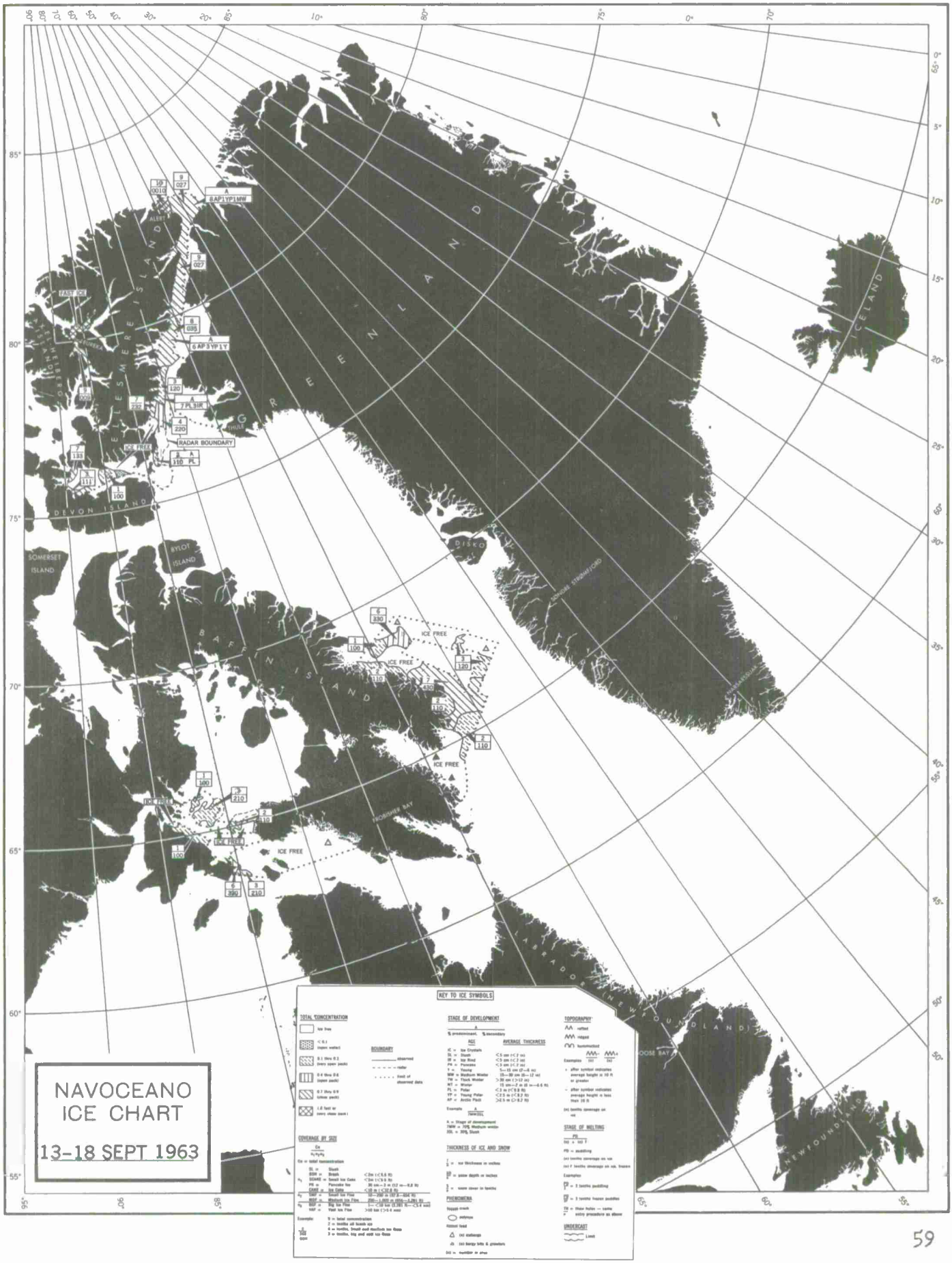
13-18 AUG 1963


GREENLAND
ICELAND
ELLESMERE ISLAND
DEVON ISLAND
SOMERSET ISLAND
BYLOT ISLAND
BAFFIN ISLAND
ALERT
EUREKA
THULE
DISKO
SONDRE STROMFJORD
NANISIVIK
FROBISHER BAY
ICE FREE
MANY BERGS BERGY BITS THROUGHOUT
ALL AGES NOT NOTED
NORTH 67N
SOUTH 67N
FEW BERGS BERGY THROUGHOUT
KEY TO ICE SYMBOLS
TOTAL CONCENTRATION
BOUNDARY
COVERAGE BY SIZE
STAGE OF DEVELOPMENT
AVERAGE THICKNESS
THICKNESS OF ICE AND SNOW
PHENOMENA
TOPOGRAPHY
STAGE OF MELTING
UNDERCAST
NAVOCEANO
ICE CHART
19-24 AUG 1963


NAVOCEANO
ICE CHART
25–31 AUG 1963
KEY TO ICE SYMBOLS
GREENLAND
ELLESMERE ISLAND
DEVON ISLAND
SOMERSET ISLAND
BYLOT ISLAND
BAFFIN ISLAND
BAFFIN BAY
ALL AGES 9TW1YP
ICE FREE
FAST ICE
RADAR BOUNDARY
THROUGHOUT
DISKO
ICELAND
NEWFOUNDLAND
LABRADOR
FROBISHER BAY
TOTAL CONCENTRATION
BOUNDARY
STAGE OF DEVELOPMENT
AVERAGE THICKNESS
TOPOGRAPHY
COVERAGE BY ICE
THICKNESS OF ICE AND SNOW
PHENOMENA
STAGE OF MELTING
UNDERCAST


NAVOCEANO
ICE CHART
1–6 SEPT 1963
KEY TO ICE SYMBOLS
GREENLAND
ELLESMERE ISLAND
DEVON ISLAND
SOMERSET ISLAND
BYLOT ISLAND
BAFFIN ISLAND
ICELAND
DISKO
THULE
ALERT
FROBISHER BAY
GOOSE BAY
LABRADOR
NEWFOUNDLAND
ICE FREE


NAVOCEANO
ICE CHART
7-12 SEPT 1963
KEY TO ICE SYMBOLS
TOTAL CONCENTRATION
BOUNDARY
COVERAGE BY SIZE
STAGE OF DEVELOPMENT
AGE
AVERAGE THICKNESS
THICKNESS OF ICE AND SNOW
PHENOMENA
TOPOGRAPHY
STAGE OF MELTING
UNDERCAST
GREENLAND
ICELAND
ELLESMERE ISLAND
DEVON ISLAND
SOMERSET ISLAND
BYLOT ISLAND
BAFFIN ISLAND
LABRADOR
NEWFOUNDLAND
GOOSE BAY
FROBISHER BAY
DISKO
ICE FREE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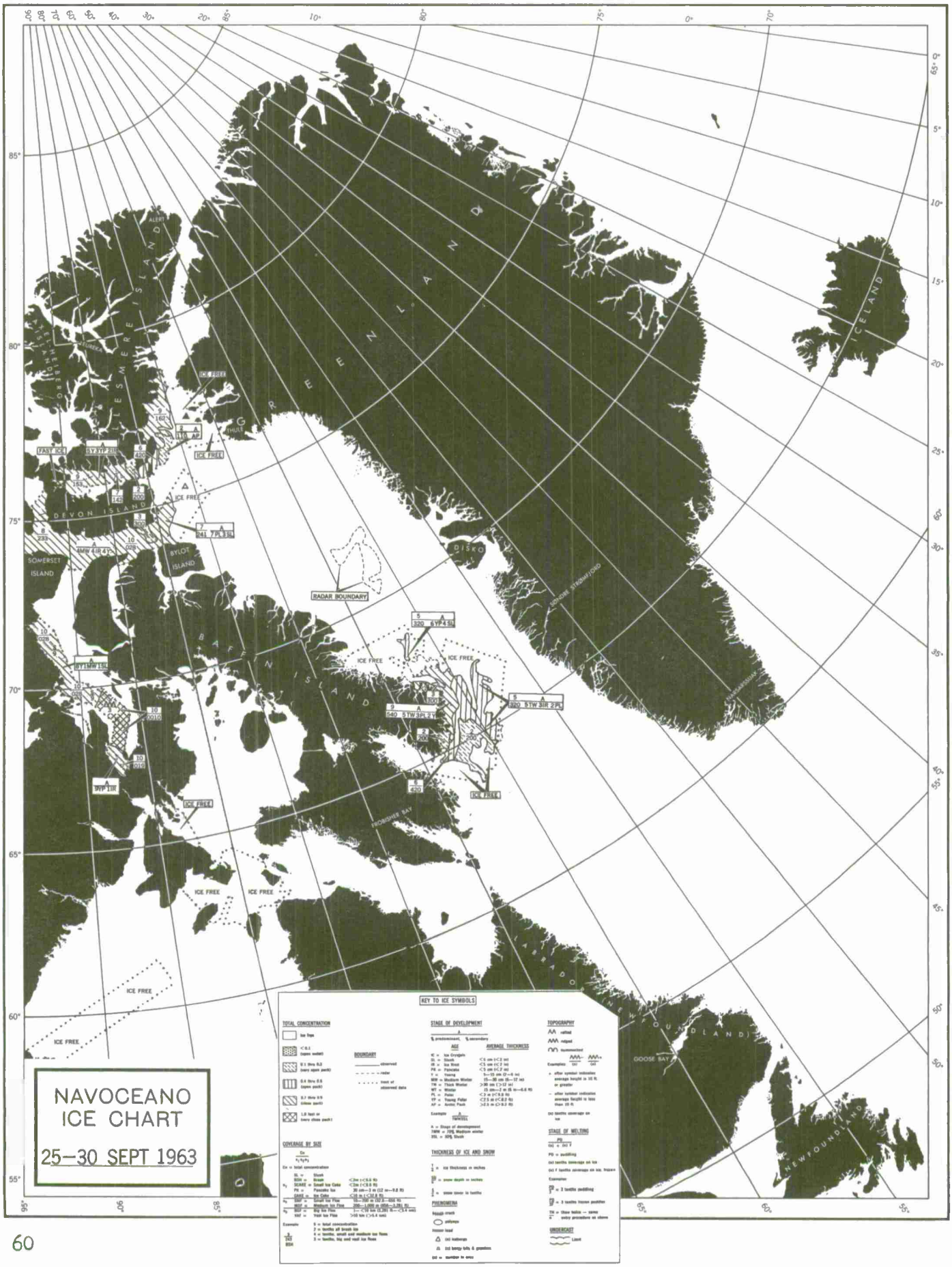
ICE CHART
13-18 SEPT 1963
KEY TO ICE SYMBOLS
TOTAL CONCENTRATION
BOUNDARY
STAGE OF DEVELOPMENT
AGE
AVERAGE THICKNESS
TOPOGRAPHY
COVERAGE BY SIZE
THICKNESS OF ICE AND SNOW
PHENOMENA
STAGE OF MELTING
UNDERCAST
GREENLAND
ELLESMERE ISLAND
DEVON ISLAND
SOMERSET ISLAND
BYLOT ISLAND
BAFFIN ISLAND
ICELAND
DISKO
ALERT
EUREKA
THULE
RADAR BOUNDARY
ICE FREE
FROBISHER BAY
GOOSE BAY
LABRADOR (NEWFOUNDLAND)
NEWFOUNDLAND


NAVOCEANO
ICE CHART
25–30 SEPT 1963
KEY TO ICE SYMBOLS
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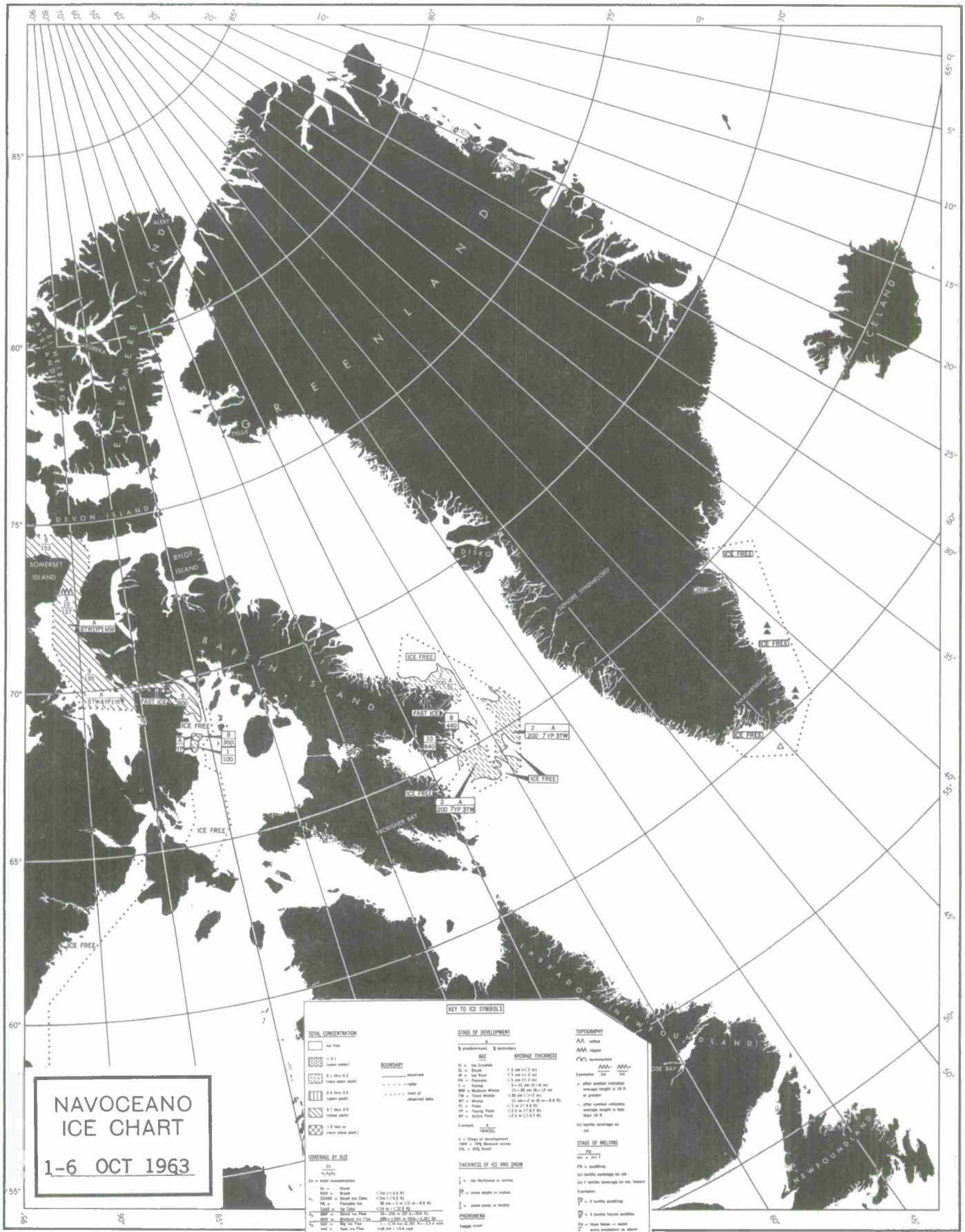
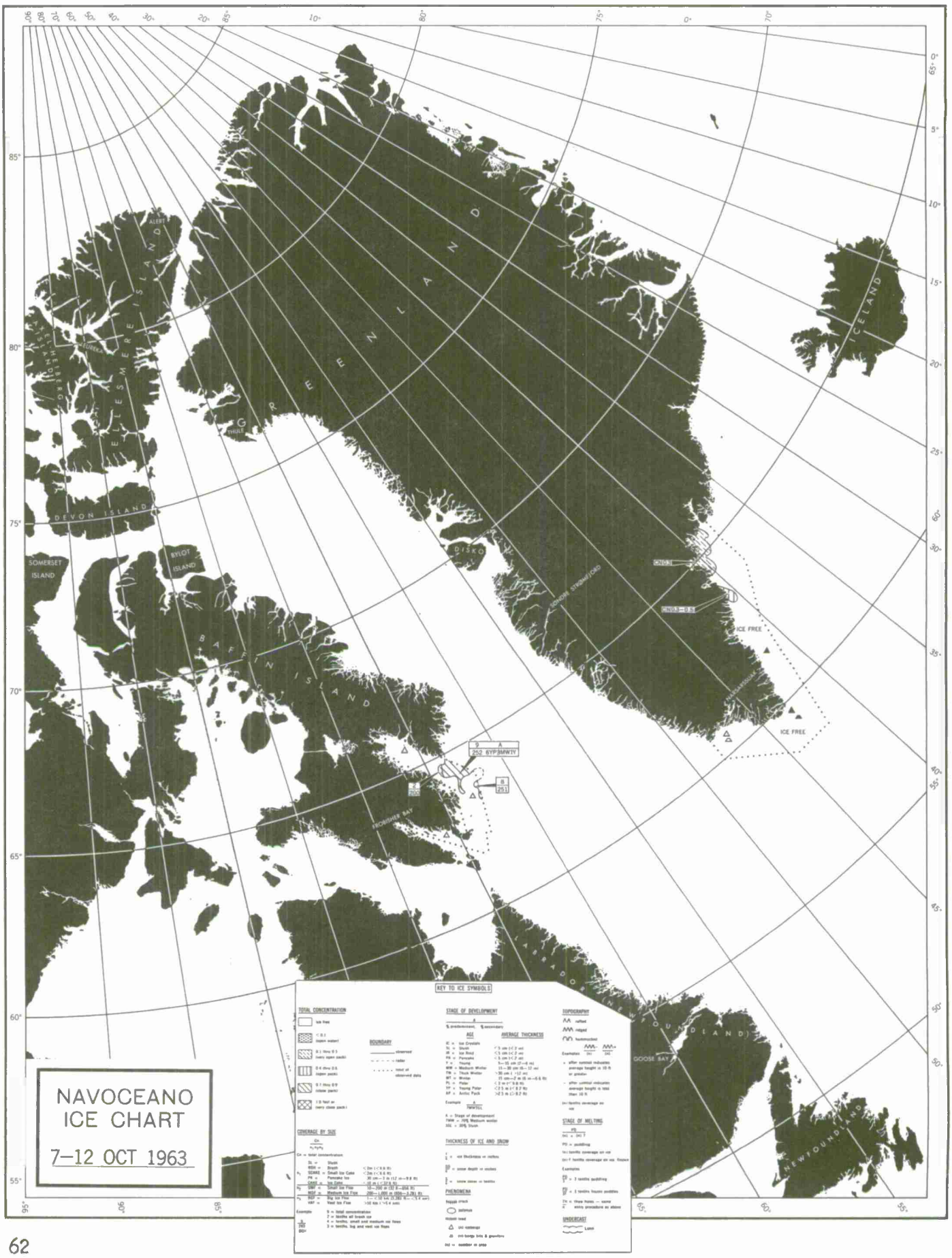
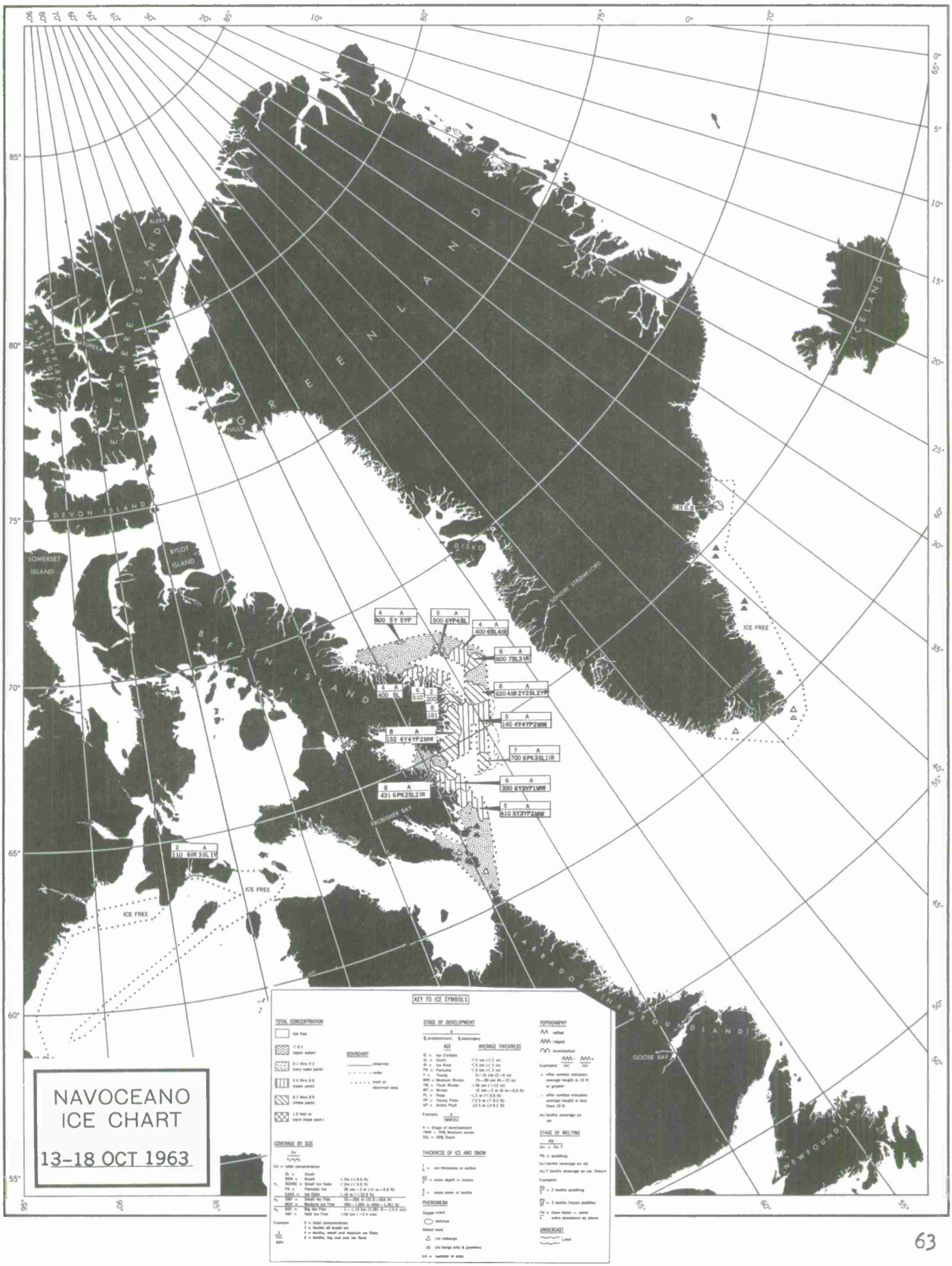
GREENLAND
ICELAND
DEVON ISLAND
SOMERSET ISLAND
BYLOT ISLAND
BAFFIN ISLAND
DISKO
ALERT
THULE
RADAR BOUNDARY
ICE FREE
FAST ICE
FROBISHER BAY
GOOSE BAY
NEWFOUNDLAND
LABRADOR
TOTAL CONCENTRATION
BOUNDARY
STAGE OF DEVELOPMENT
AGE
AVERAGE THICKNESS
TOPOGRAPHY
COVERAGE BY SIZE
THICKNESS OF ICE AND SNOW
PHENOMENA
STAGE OF MELTING
UNDERCAST

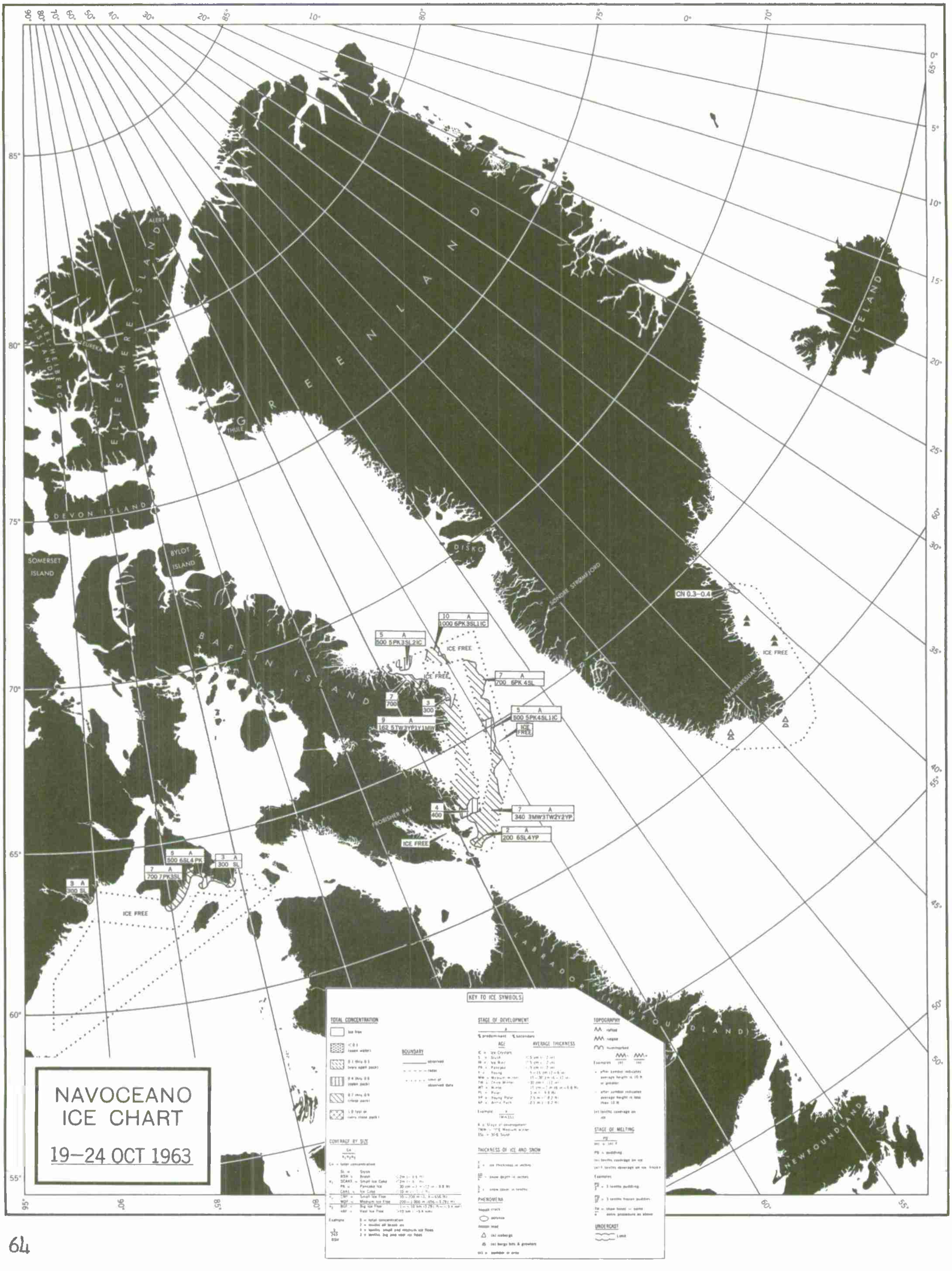


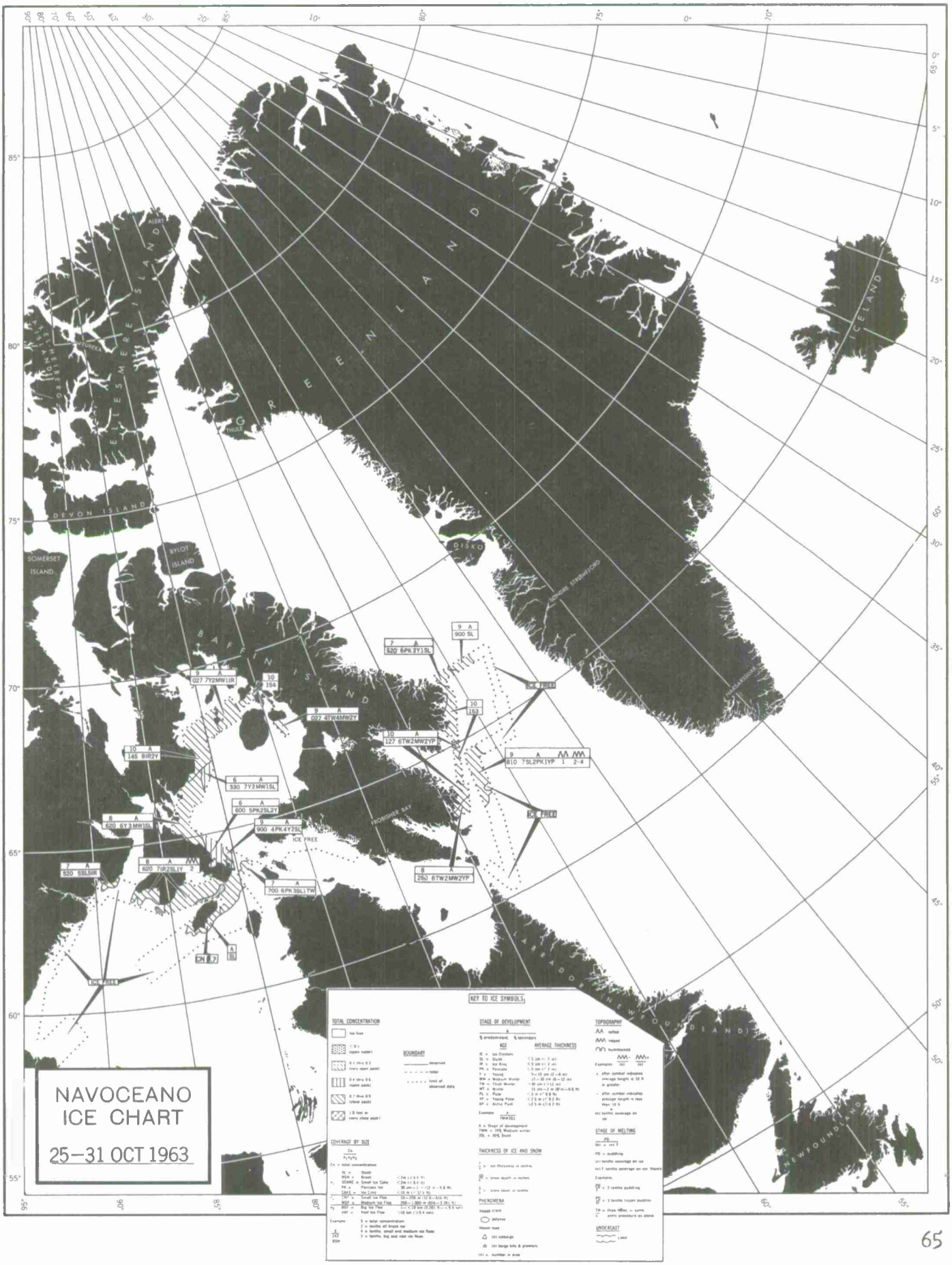
NAVOCEANO
ICE CHART

1-6 OCT 1963


NAVOCEANO
ICE CHART
7–12 OCT 1963
KEY TO ICE SYMBOLS
GREENLAND
ICELAND
ELLESMERE ISLAND
DEVON ISLAND
SOMERSET ISLAND
BYLOT ISLAND
BAFFIN ISLAND
ALERT
EUREKA
THULE
DISKO
UPERNAVIK
UMMANNAQ
ICE FREE
FROBISHER BAY
GOOSE BAY
LABRADOR
NEWFOUNDLAND
TOTAL CONCENTRATION
BOUNDARY
STAGE OF DEVELOPMENT
AGE
AVERAGE THICKNESS
TOPOGRAPHY
COVERAGE BY SIZE
STAGE OF MELTING
THICKNESS OF ICE AND SNOW
PHENOMENA
UNDERCAST

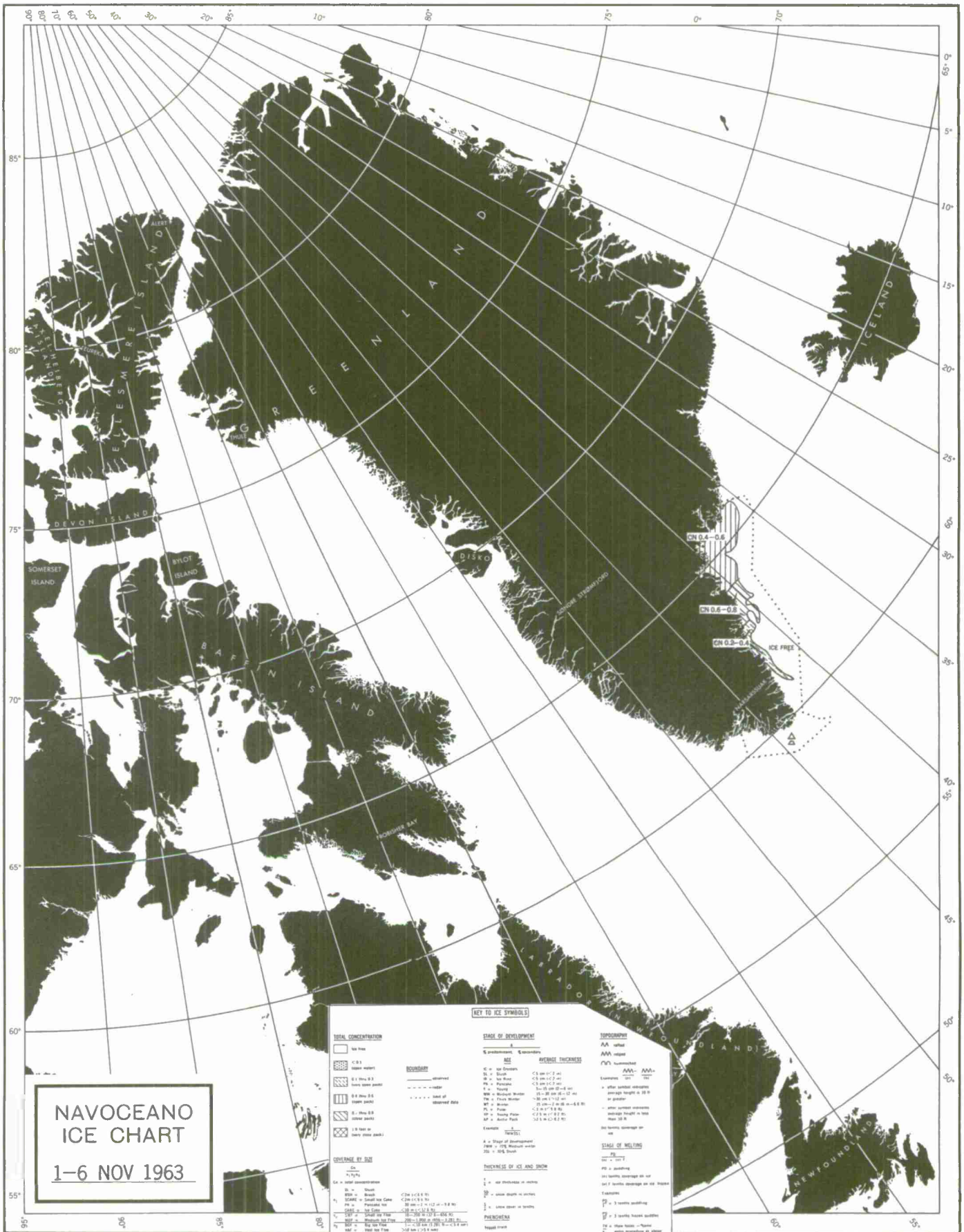

GREENLAND
ELLESMERE ISLAND
DEVON ISLAND
SOMERSET ISLAND
BYLOT ISLAND
BAFFIN ISLAND
ICELAND
ALERT
EUREKA
THULE
DISKO
JAKOBSHAVN
UMANAKFJORD
ICE FREE
ICE FREE
ICE FREE
FROBISHER BAY
LABRADOR
NEWFOUNDLAND
GOOSE BAY
4 A 600 5Y 5YP
5 A 500 6YP4SL
4 A 400 6SL4IR
6 A 800 7SL3IR
4 A 400 SL
6 510
2 200
6 161
8 A 620 4IR 2Y2SL2YP
8 A 152 4Y4YP2MW
5 A 140 4Y4YP2MW
7 A 700 6PK3SL1IR
6 A 330 6Y3YP1MW
8 A 431 6PK2SL2IR
6 A 410 5Y3YP2MW
2 A 110 6IR 3SL1Y
KEY TO ICE SYMBOLS
TOTAL CONCENTRATION
BOUNDARY
COVERAGE BY SIZE
STAGE OF DEVELOPMENT
AGE
AVERAGE THICKNESS
THICKNESS OF ICE AND SNOW
PHENOMENA
TOPOGRAPHY
STAGE OF MELTING
UNDERCAST
NAVOCEANO
ICE CHART
13-18 OCT 1963

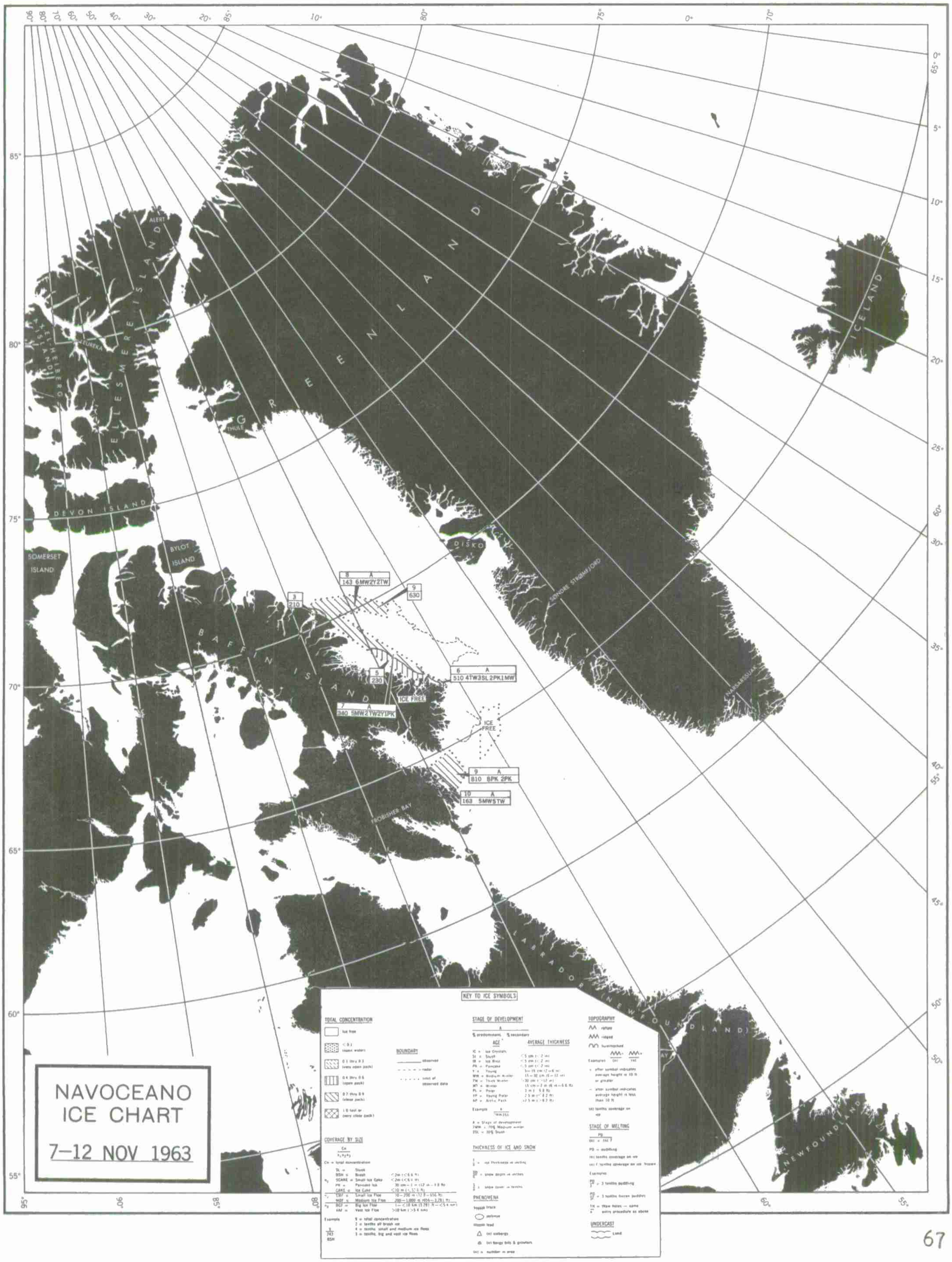

NAVOCEANO
ICE CHART
19–24 OCT 1963
GREENLAND
ICELAND
ELLESMERE ISLAND
AXEL HEIBERG ISLAND
DEVON ISLAND
SOMERSET ISLAND
BYLOT ISLAND
BAFFIN ISLAND
DISKO
THULE
EUREKA
ALERT
SONDRE STROMFJORD
NARSARSSUAQ
FROBISHER BAY
LABRADOR
NEWFOUNDLAND
ICE FREE
CN 0.3–0.4
10 A 1000 6PK3SL1IC
5 A 500 5PK3SL2IC
7 A 700 6PK 4SL
5 A 800 5PK4SL1IC
7 A 340 3MW3TW2Y2YP
2 A 200 6SL4YP
5 A 500 6SL4 PK
7 A 700 7PK3SL
3 A 300 SL
KEY TO ICE SYMBOLS
TOTAL CONCENTRATION
BOUNDARY
observed
radar
COVERAGE BY SIZE
STAGE OF DEVELOPMENT
AGE
AVERAGE THICKNESS
THICKNESS OF ICE AND SNOW
PHENOMENA
TOPOGRAPHY
STAGE OF MELTING
UNDERCAST

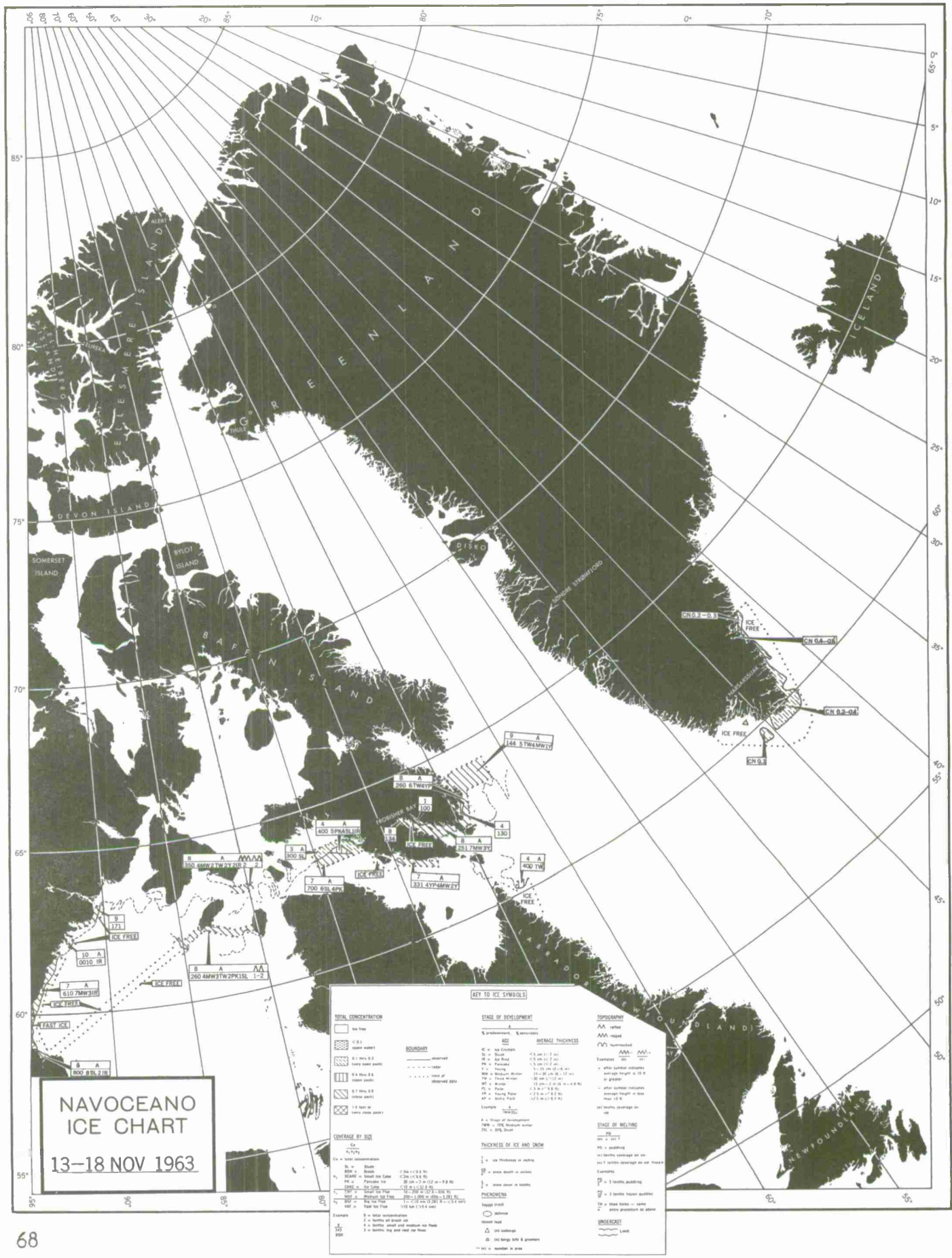


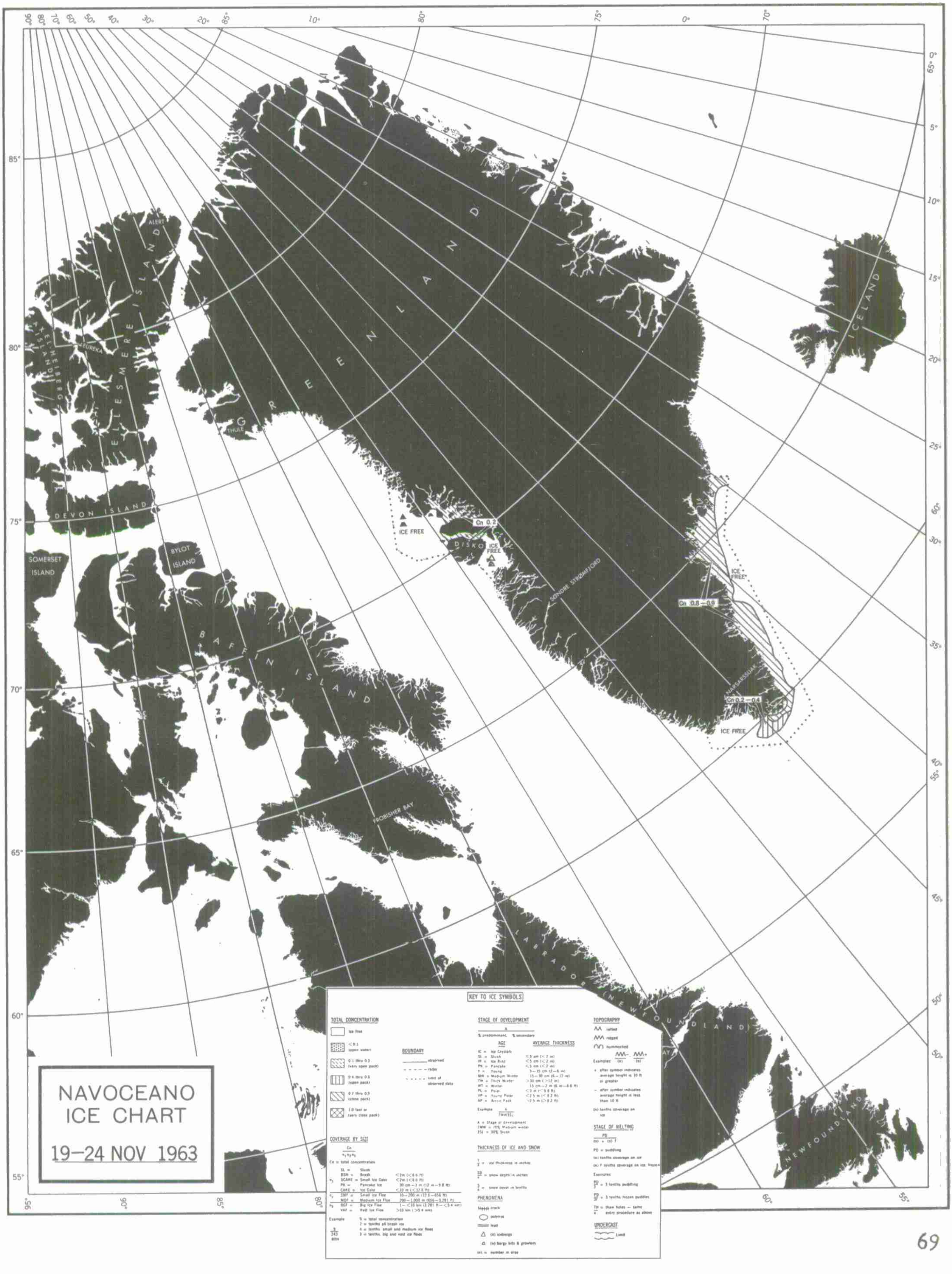
NAVOCEANO
ICE CHART

25–31 OCT 1963

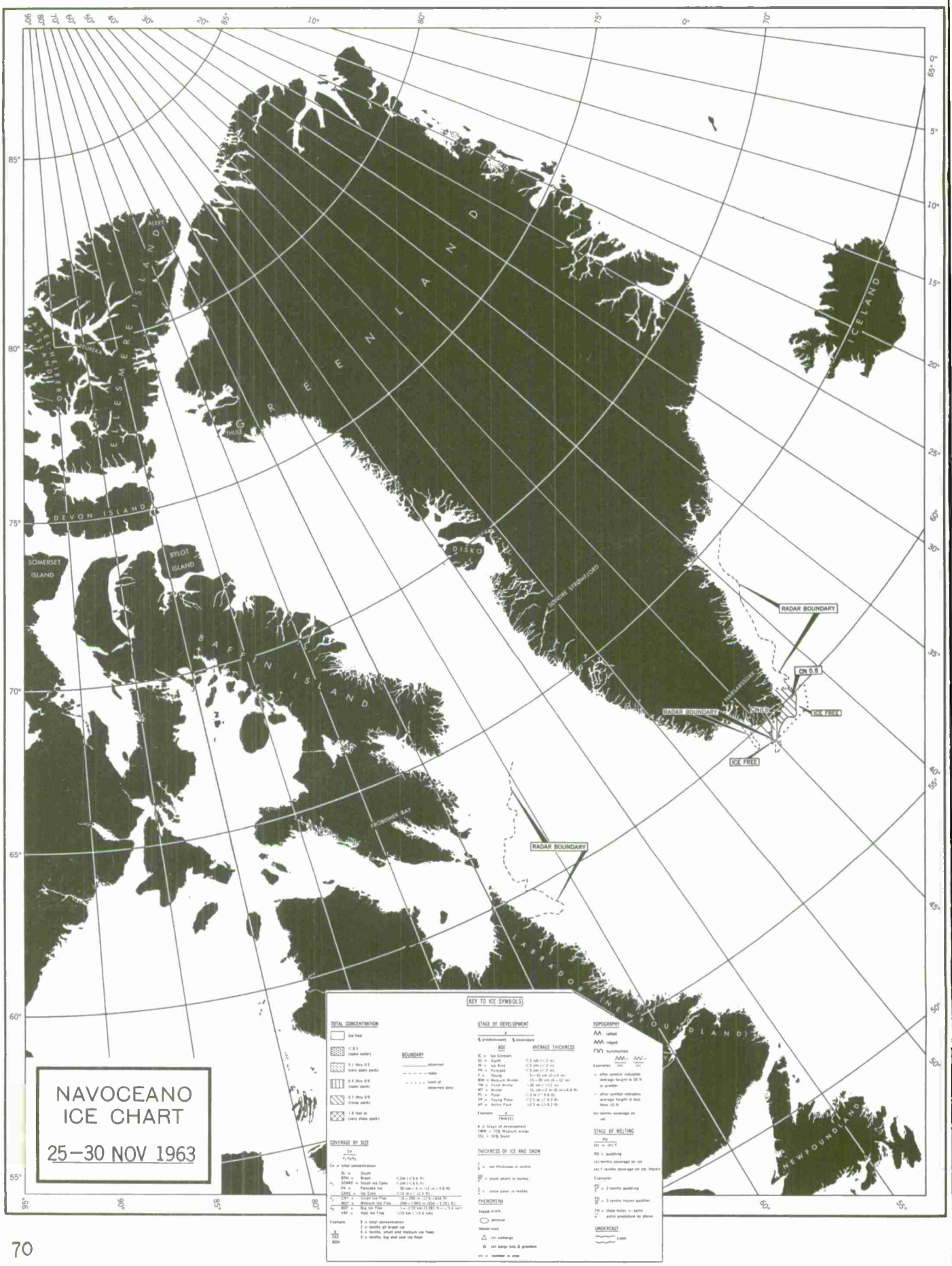

NAVOCEANO
ICE CHART
1–6 NOV 1963
KEY TO ICE SYMBOLS
TOTAL CONCENTRATION
BOUNDARY
STAGE OF DEVELOPMENT
AGE
AVERAGE THICKNESS
TOPOGRAPHY
COVERAGE BY SIZE
THICKNESS OF ICE AND SNOW
PHENOMENA
STAGE OF MELTING
UNDERCAST
GREENLAND
ELLESMERE ISLAND
DEVON ISLAND
SOMERSET ISLAND
BYLOT ISLAND
BAFFIN ISLAND
ICELAND
NEWFOUNDLAND
LABRADOR
DISKO
FROBISHER BAY
CN 0.4–0.6
CN 0.6–0.8
CN 0.2–0.4
ICE FREE

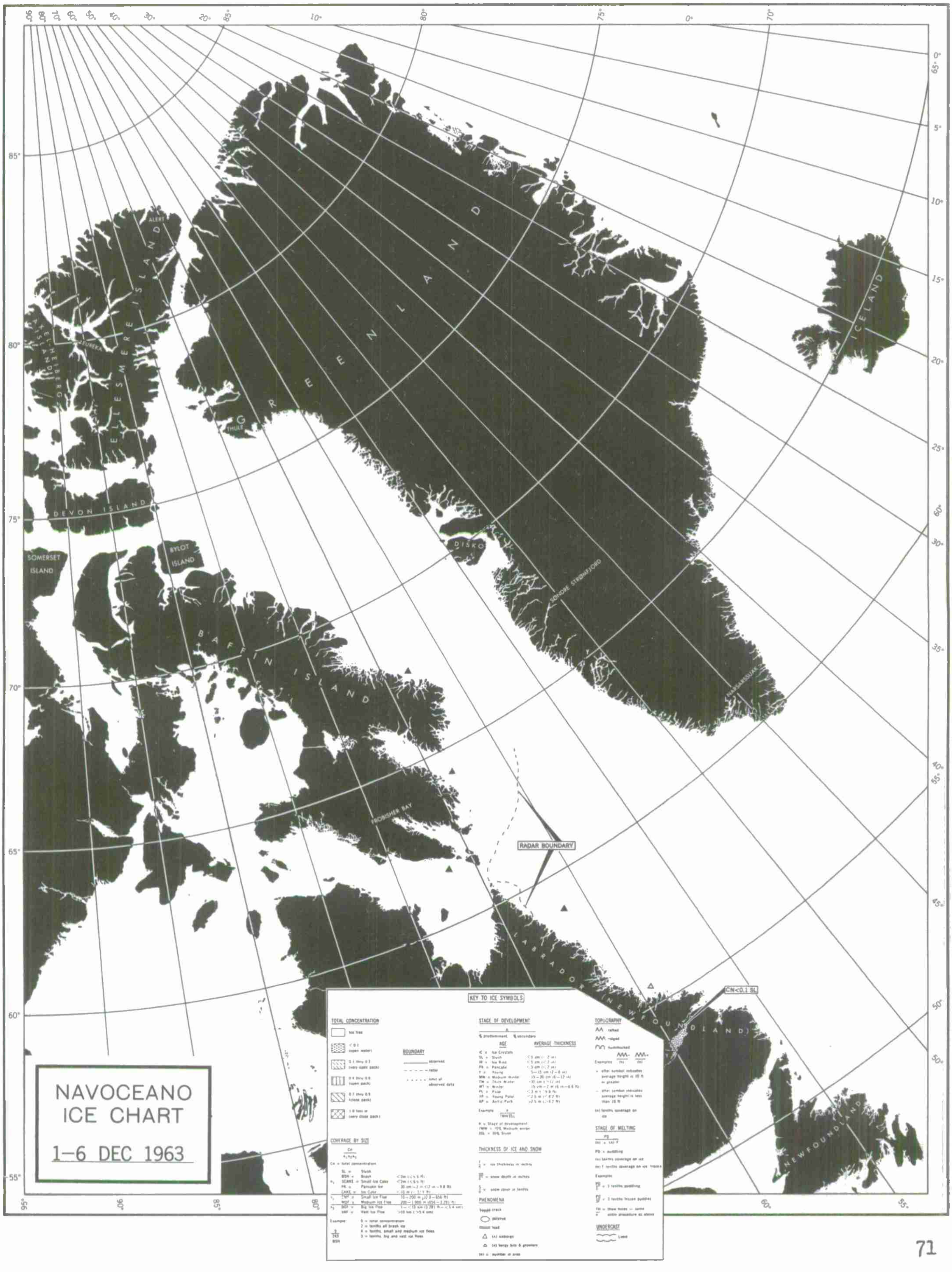

NAVOCEANO
ICE CHART
7–12 NOV 1963
GREENLAND
ICELAND
ELLESMERE ISLAND
AXEL HEIBERG ISLAND
ALERT
EUREKA
THULE
DEVON ISLAND
SOMERSET ISLAND
BYLOT ISLAND
BAFFIN ISLAND
DISKO
SØNDRE STRØMFJORD
NARSARSSUAK
FROBISHER BAY
LABRADOR
NEWFOUNDLAND
ICE FREE
8 A 143 6MW2Y2TW
9 630
3 210
5 230
6 A 510 4TW3SL 2PK1MW
7 A 340 5MW2TW2Y1PK
9 A 810 8PK 2PK
10 A 163 5MWSTW
KEY TO ICE SYMBOLS
TOTAL CONCENTRATION
BOUNDARY
STAGE OF DEVELOPMENT
AGE
AVERAGE THICKNESS
TOPOGRAPHY
COVERAGE BY SIZE
THICKNESS OF ICE AND SNOW
STAGE OF MELTING
PHENOMENA
UNDERCAST

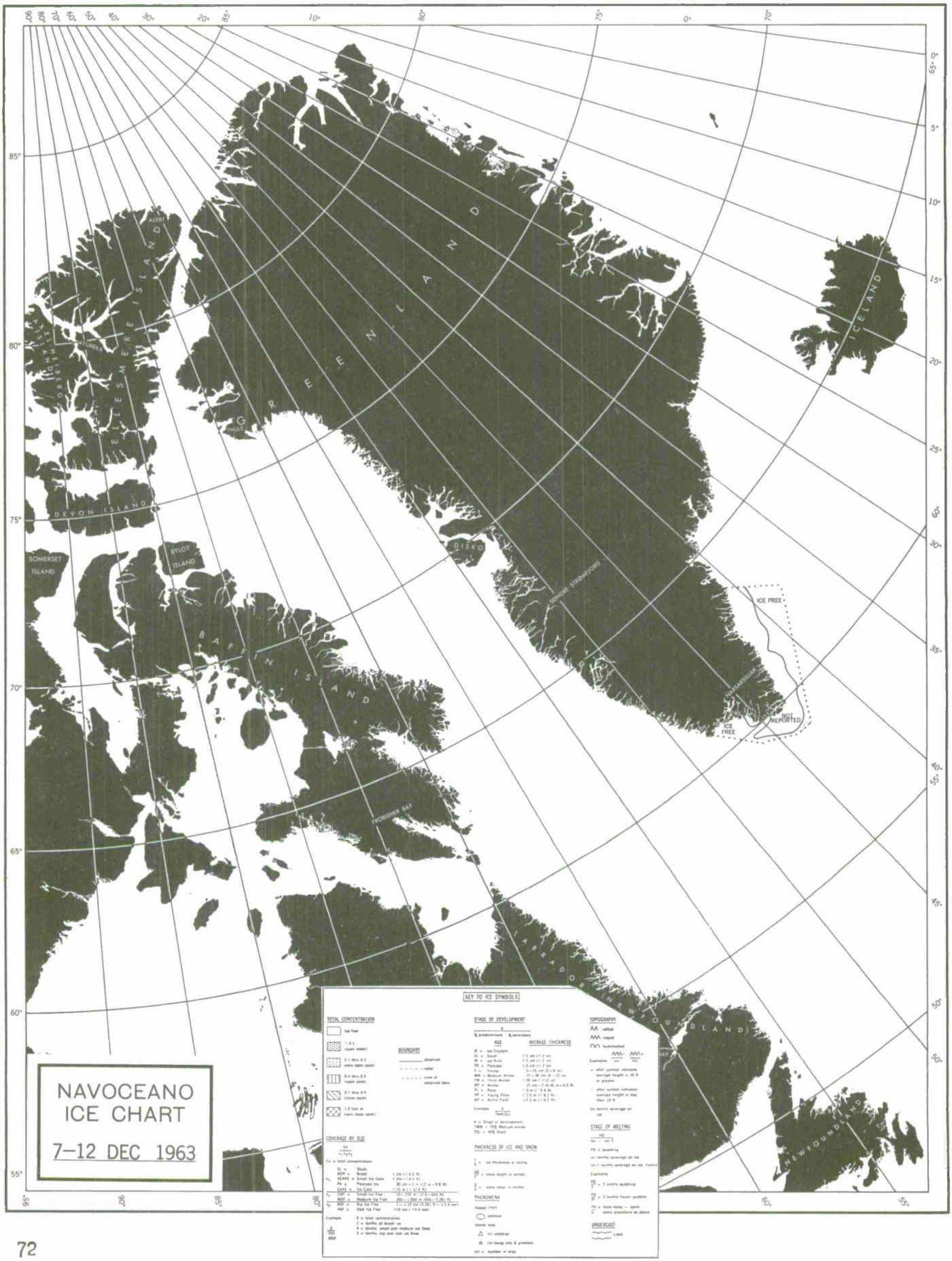

NAVOCEANO
ICE CHART
13–18 NOV 1963
KEY TO ICE SYMBOLS
TOTAL CONCENTRATION
BOUNDARY
STAGE OF DEVELOPMENT
AGE
AVERAGE THICKNESS
TOPOGRAPHY
COVERAGE BY SIZE
THICKNESS OF ICE AND SNOW
PHENOMENA
STAGE OF MELTING
UNDERCAST
GREENLAND
ELLESMERE ISLAND
DEVON ISLAND
SOMERSET ISLAND
BYLOT ISLAND
BAFFIN ISLAND
ICELAND
NEWFOUNDLAND
LABRADOR
ALERT
THULE
DISKO
SONDRE STROMFJORD
FROBISHER BAY
ICE FREE
FAST ICE
CN 0.2–0.3
CN 0.4–0.6
CN 0.2–0.4
CN 0.1
9 A 144 5TW4MW1Y
8 A 260 6TW6Y
1 100
4 A 400 5PK4SL1IR
4 130
8 A 251 7MW3Y
3 A 300 SL
8 A 330 4MW3TW2PK2SL 2
4 A 400 TW
7 A 700 6SL4PK
7 A 331 4YP4MW2Y
9 171
10 A 0010 1R
8 A 260 4MW3TW2PK1SL 1–2
7 A 610 7MW3IR
8 A 800 8SL2IB

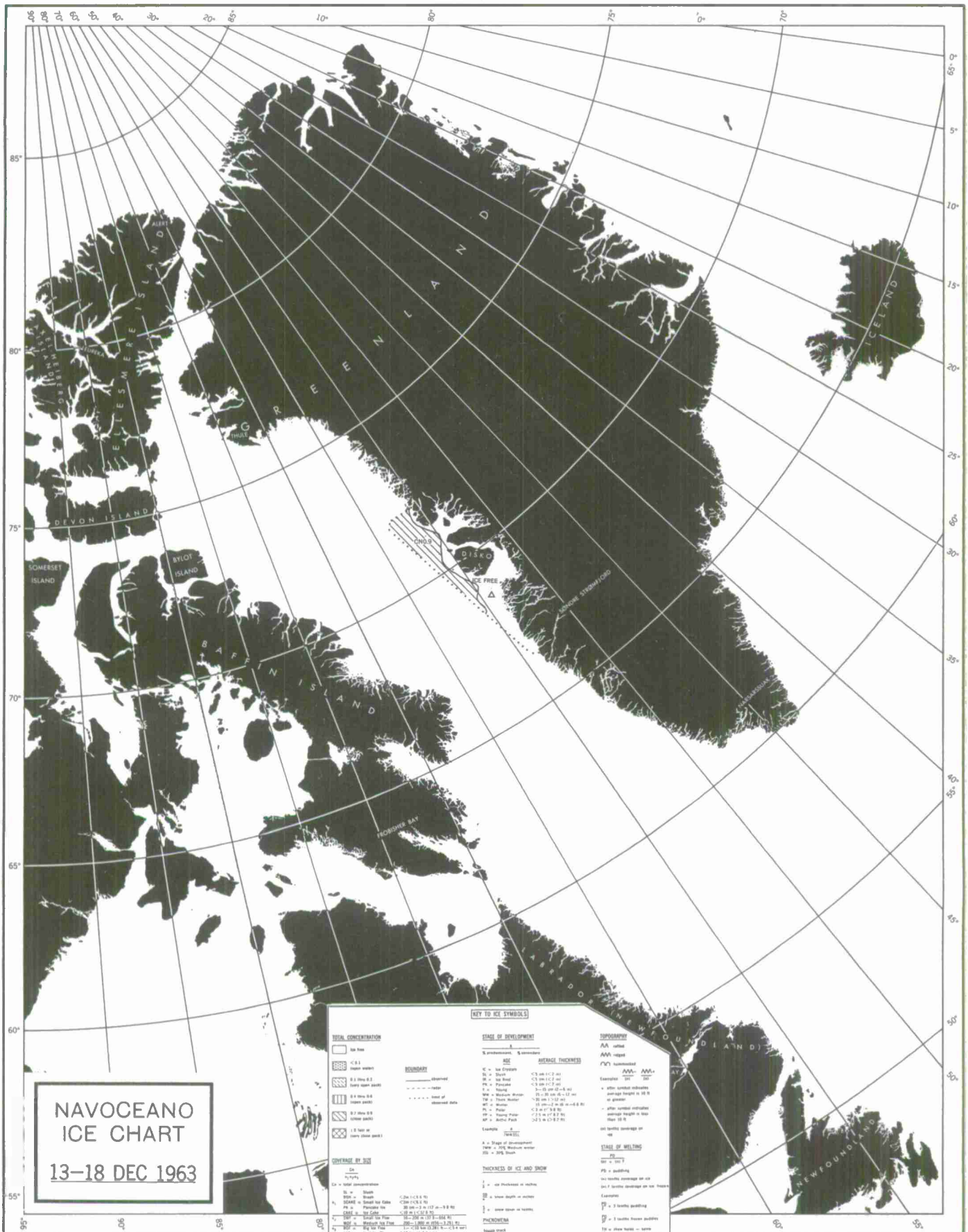


NAVOCEANO
ICE CHART
19—24 NOV 1963
GREENLAND
ELLESMERE ISLAND
AXEL HEIBERG ISLAND
ALERT
EUREKA
THULE
DEVON ISLAND
SOMERSET ISLAND
BYLOT ISLAND
BAFFIN ISLAND
FROBISHER BAY
DISKO
ICE FREE
Cn 0.2
SØNDRE STRØMFJORD
ICE FREE
Cn 0.8—0.9
NARSARSSUAQ
Cn 0.2—0.4
ICE FREE
ICELAND
LABRADOR
NEWFOUNDLAND
KEY TO ICE SYMBOLS
TOTAL CONCENTRATION
Ice free
<0.1 (open water)
0.1 thru 0.3 (very open pack)
0.4 thru 0.6 (open pack)
0.7 thru 0.9 (close pack)
1.0 fast or (very close pack)
BOUNDARY
observed
radar
limit of observed data
COVERAGE BY SIZE
Cn = total concentration
STAGE OF DEVELOPMENT
AGE
AVERAGE THICKNESS
THICKNESS OF ICE AND SNOW
PHENOMENA
crack
polynya
lead
(n) icebergs
(n) bergy bits & growlers
(n) = number in area
TOPOGRAPHY
rafted
ridged
hummocked
STAGE OF MELTING
PD = puddling
UNDERCAST
Limit


NAVOCEANO
ICE CHART
25–30 NOV 1963
KEY TO ICE SYMBOLS
TOTAL CONCENTRATION
BOUNDARY
COVERAGE BY SIZE
STAGE OF DEVELOPMENT
AVERAGE THICKNESS
TOPOGRAPHY
STAGE OF MELTING
THICKNESS OF ICE AND SNOW
PHENOMENA
UNDERCAST
RADAR BOUNDARY
RADAR BOUNDARY
RADAR BOUNDARY
ICE FREE
ICE FREE
CN 0.6
GREENLAND
ELLESMERE ISLAND
DEVON ISLAND
SOMERSET ISLAND
BYLOT ISLAND
BAFFIN ISLAND
ICELAND
NEWFOUNDLAND
LABRADOR
DISKO
FROBISHER BAY
ALERT
EUREKA
THULE
85°
80°
75°
70°
65°
60°
55°

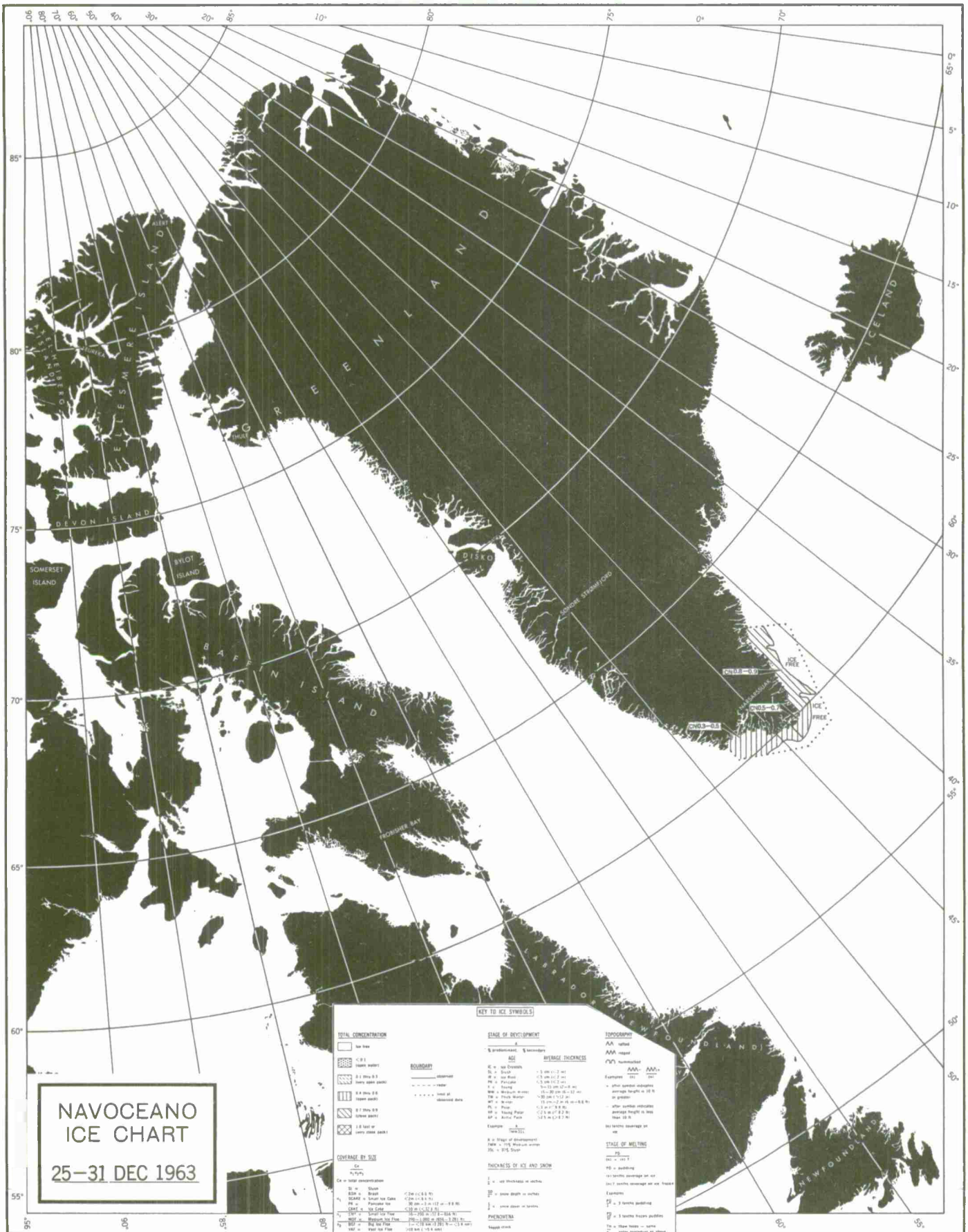

NAVOCEANO
ICE CHART
1—6 DEC 1963
KEY TO ICE SYMBOLS
TOTAL CONCENTRATION
BOUNDARY
COVERAGE BY SIZE
STAGE OF DEVELOPMENT
THICKNESS OF ICE AND SNOW
PHENOMENA
TOPOGRAPHY
STAGE OF MELTING
UNDERCAST
GREENLAND
ICELAND
ELLESMERE ISLAND
AXEL HEIBERG ISLAND
DEVON ISLAND
SOMERSET ISLAND
BYLOT ISLAND
BAFFIN ISLAND
DISKO
SØNDRE STRØMFJORD
NARSARSSUAQ
FROBISHER BAY
LABRADOR
NEWFOUNDLAND
ALERT
EUREKA
THULE
RADAR BOUNDARY
CN<0.1 SL


NAVOCEANO
ICE CHART
7–12 DEC 1963
KEY TO ICE SYMBOLS
TOTAL CONCENTRATION
BOUNDARY
COVERAGE BY SIZE
STAGE OF DEVELOPMENT
AVERAGE THICKNESS
TOPOGRAPHY
THICKNESS OF ICE AND SNOW
PHENOMENA
UNDERCAST
STAGE OF MELTING
GREENLAND
ICELAND
ELLESMERE ISLAND
DEVON ISLAND
SOMERSET ISLAND
BYLOT ISLAND
BAFFIN ISLAND
DISKO
ICE FREE
NOT REPORTED
LABRADOR
NEWFOUNDLAND



NAVOCEANO ICE CHART

13–18 DEC 1963



NAVOCEANO ICE CHART

25—31 DEC 1963

APPENDIX B

DANISH ICE RECONNAISSANCE CHARTS

MINERVA MIKROFILM A/S

DANISH ICE RECONNAISSANCE

ICE CENTRAL NARSSARSSUAQ

GREENLAND

1963

THE DANISH METEOROLOGICAL INSTITUTE
NAUTICAL DEPARTMENT
GAMLEHAVE ALLE 22
CHARLOTTENLUND
DENMARK

LEGEND

COVERAGE (CONCENTRATION)

- Ice free
- <0.1 (open water)
- 0.1 thru 0.4 (scattered ice)
- 0.5 thru 0.7 (broken ice)
- 0.8 thru 0.9 (close ice)
- 1.0 (consolidated or fast Ice)

COVERAGE BY SIZE

$$\frac{Cn}{n_1, n_2, n_3}$$

n_1=tenths of slush, brash, and block
n_2=tenths of small and medium floes
n_3=tenths of giant floes and field

Example: $\frac{9}{243}$ BSH

9 = total concentration
2 = tenths all brash ice
4 = tenths, small and medium ice floes
3 = tenths, big and vast ice floes

AGE

$$\frac{A}{\%\text{ dominant, }\%\text{ secondary}}$$

Sl=Slush W=Winter ice
Y=Young ice P=Polar ice

Examples: $\frac{A}{60W, 40Pl}$ etc. $\frac{}{W}$

TOPOGRAPHY

ΛΛ Rafted ice

ΛΛ Ridged ice

ΩΩΩ Hummocks

Extent: H=very extensive
L=few present

When no entry appears beneath symbol extent is moderate
Examples:

$\frac{\Lambda\Lambda}{H}$ =very extensive ridging

ΛΛ =moderate rafting

$\frac{\Omega\Omega\Omega}{L}$ =few hummocks

WATER FEATURES

$$\frac{Pd}{\text{dominant amount in tenths unless frozen or rotten}}$$

Puddles:
F=Frozen R=Rotten

Examples: $\frac{Pd}{3}$, $\frac{Pd}{F}$, $\frac{Pd}{R}$

Crack Lead

Polynya

ICE OF LAND ORIGIN

- Icebergs—many (>20)
- Icebergs—few (<20)
- Bergy bits (>50) and growlers (>100)
- Bergy bits (<50) and growlers (<100)
- Single iceberg

THICKNESS AND SNOW COVER

Thickness: $\frac{T}{n}$ where n=feet and inches

Snow cover: $\frac{S}{n}, \frac{S}{C}, \frac{S}{D}, \frac{S}{O}$

n=depth to nearest inch

C=ice uniformly snow covered

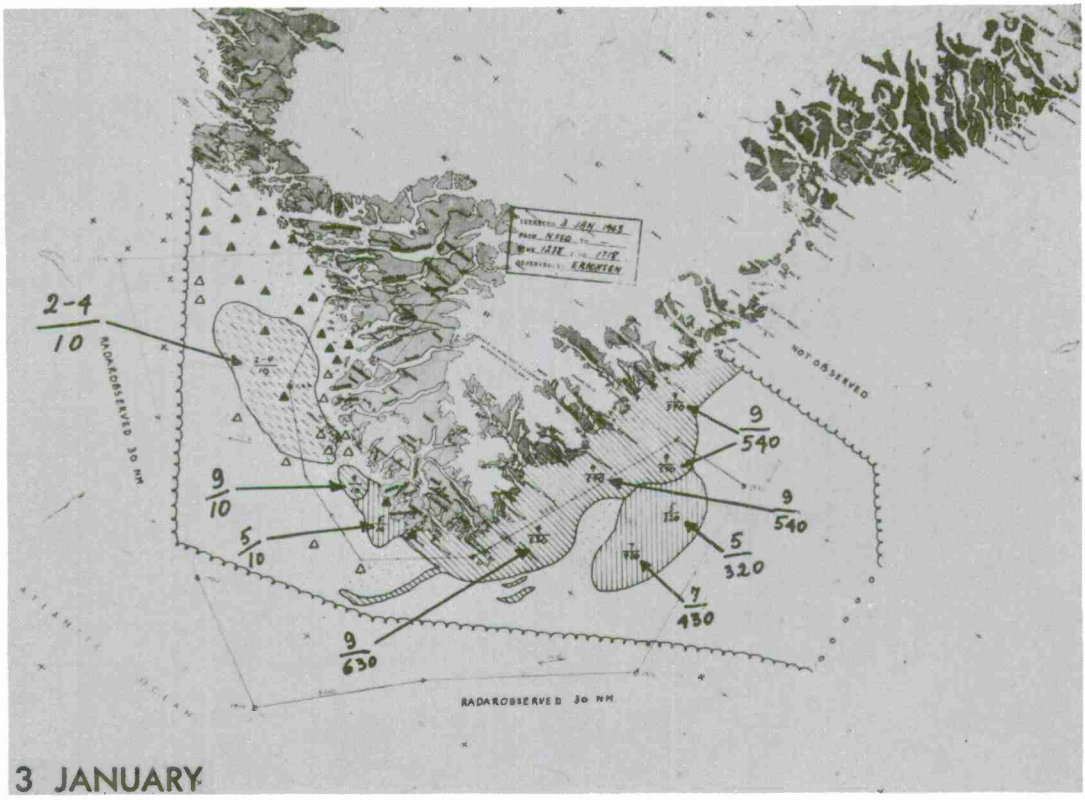
D=snow cover in drifts

O=no snow cover present

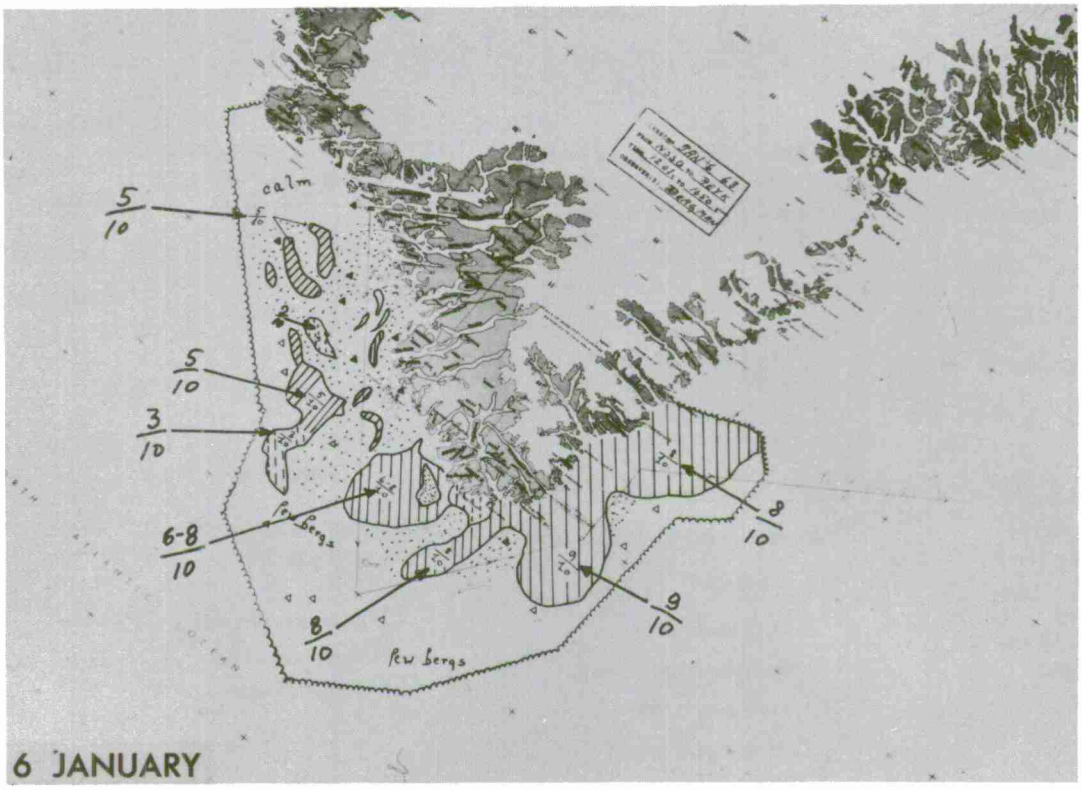
BOUNDARY

——— Observed
– – – Estimated
-x-x-x- Radar observed
o o o o o Limit of observed data

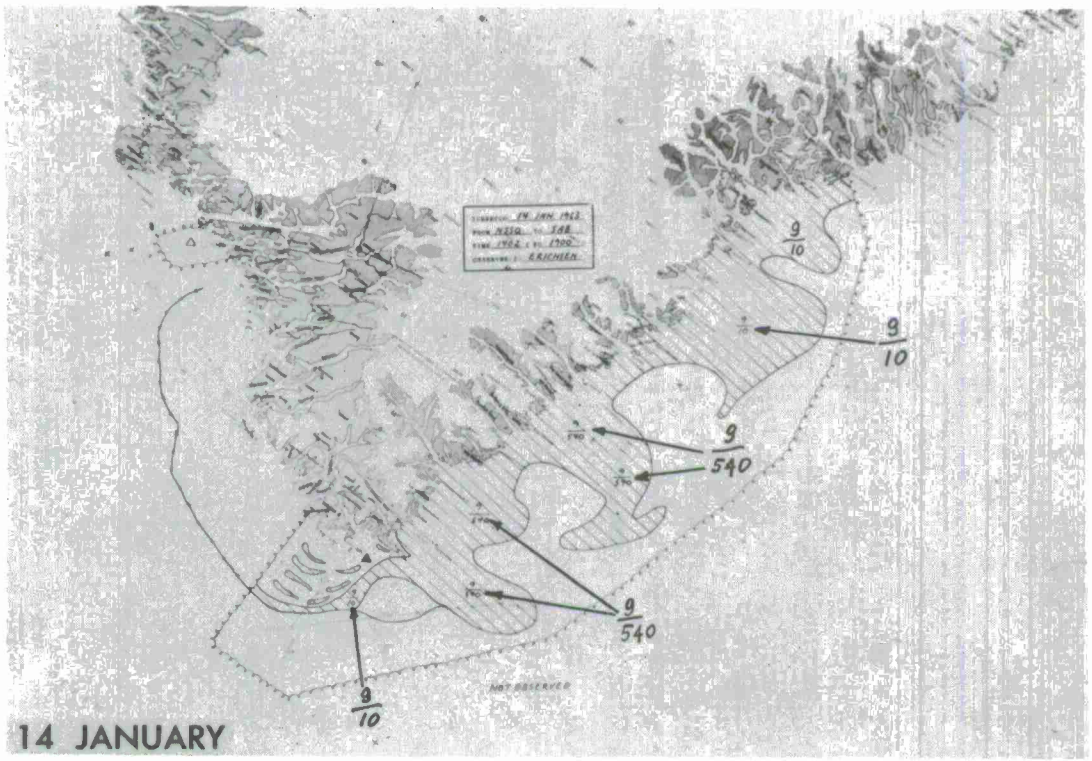
UNDERCAST
Undercast (limits)



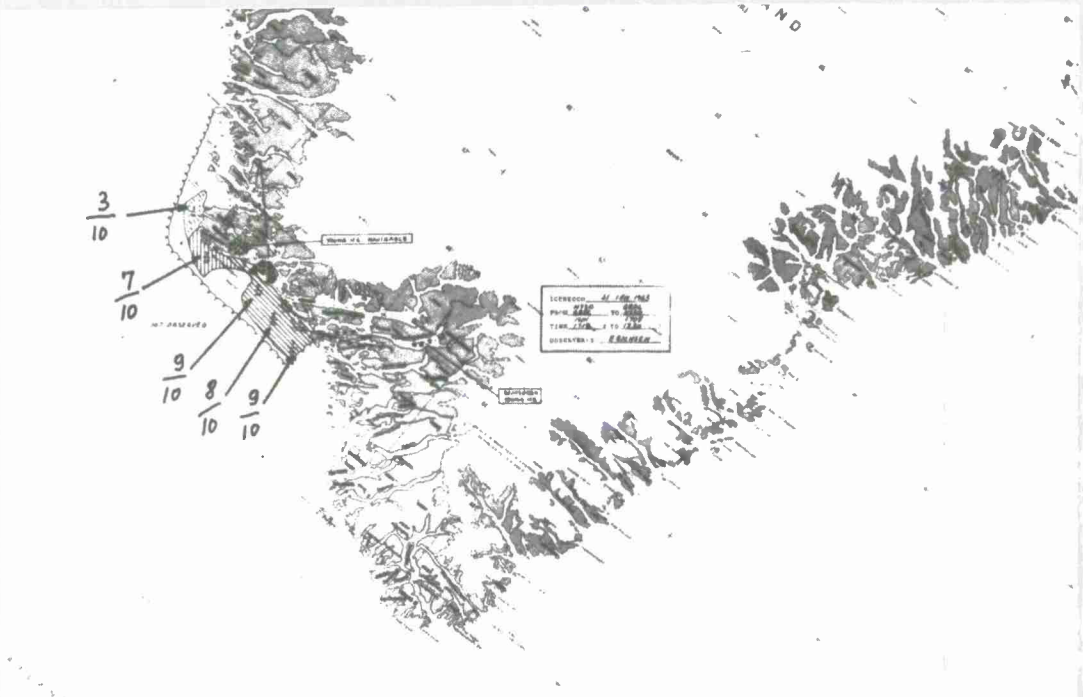
3 JANUARY



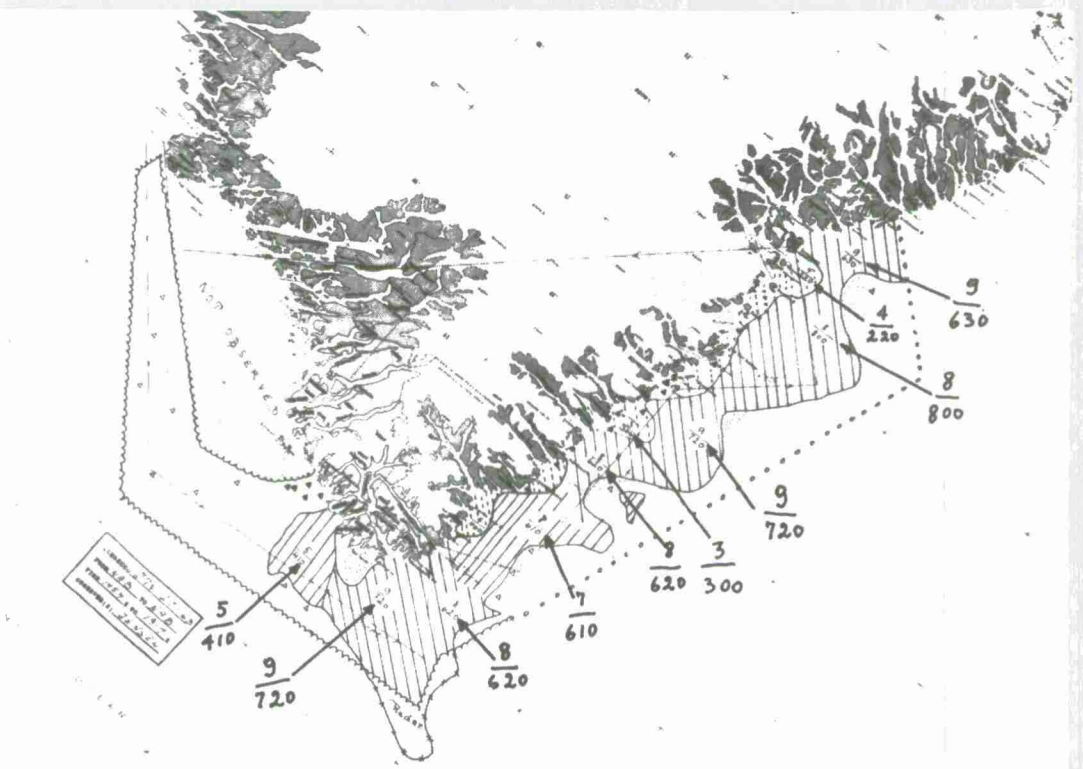
6 JANUARY


9/10
9/10
9/540
9/540
9/10
14 JANUARY

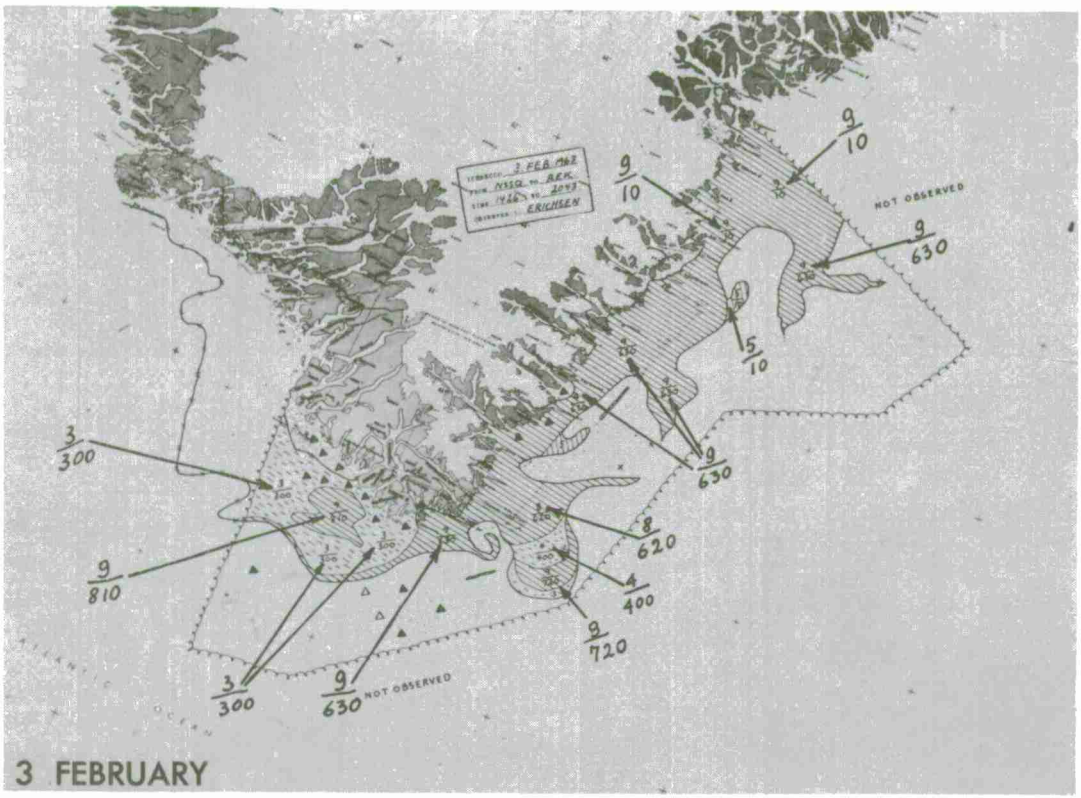

GREENLAND
NOT OBSERVED
17 JANUARY

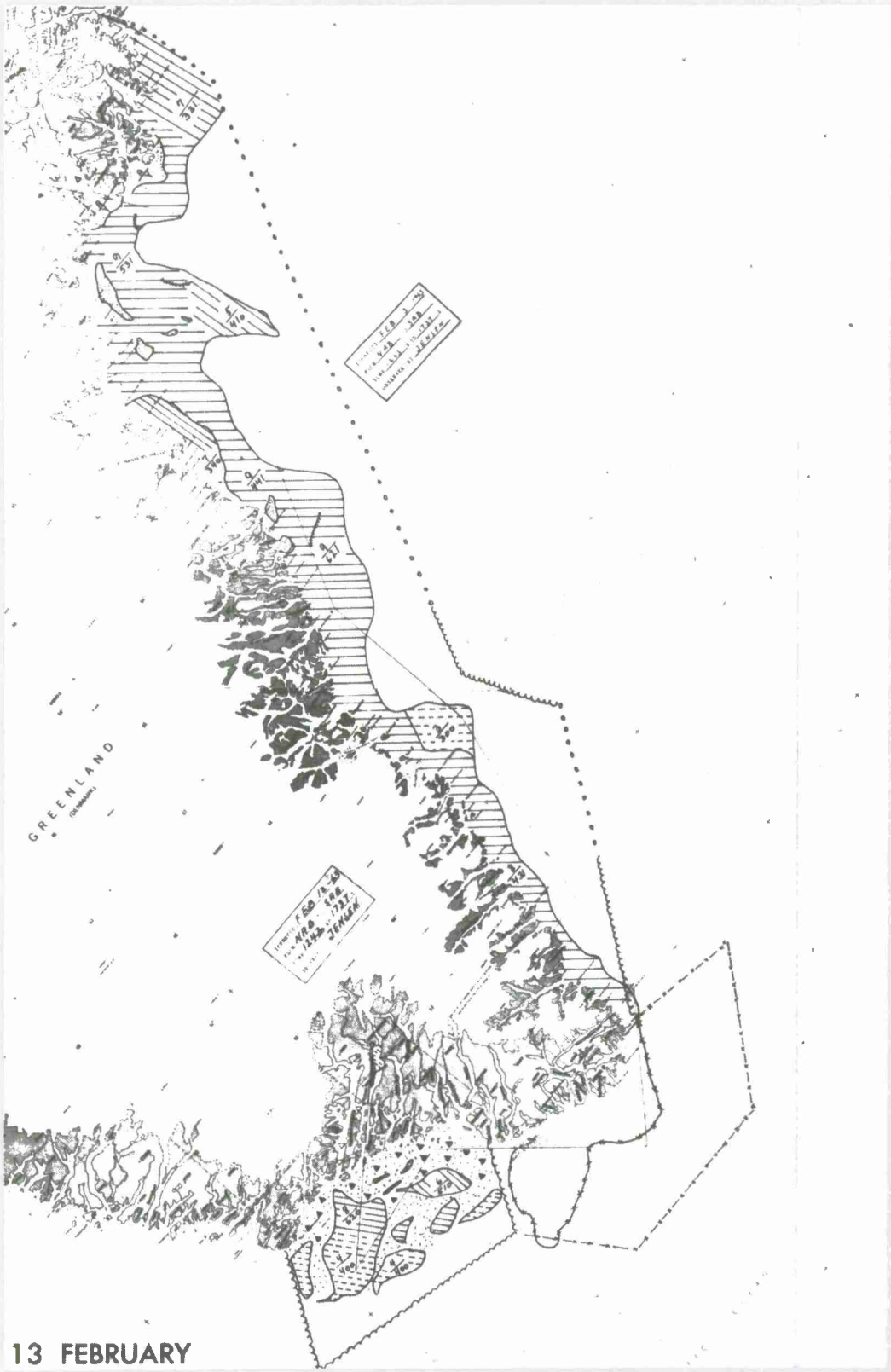


21 JANUARY

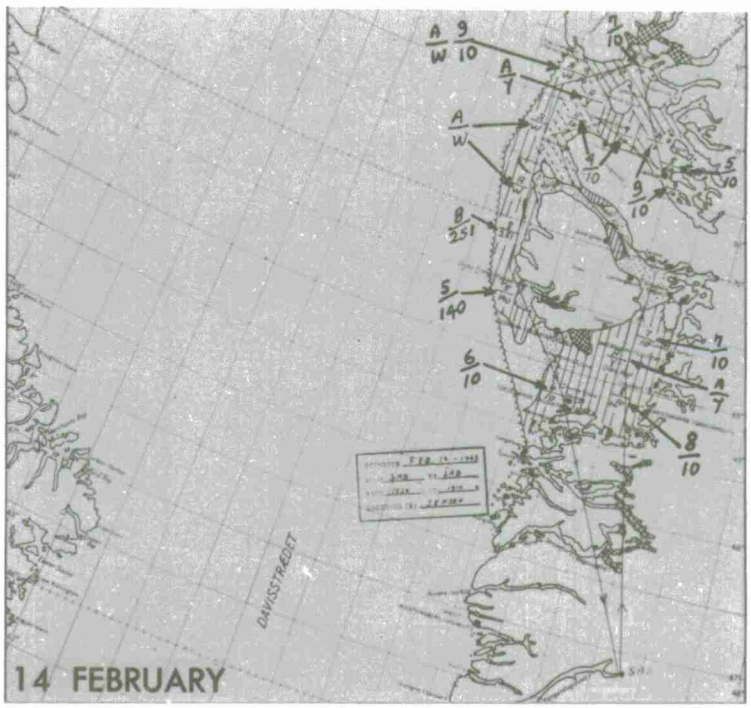


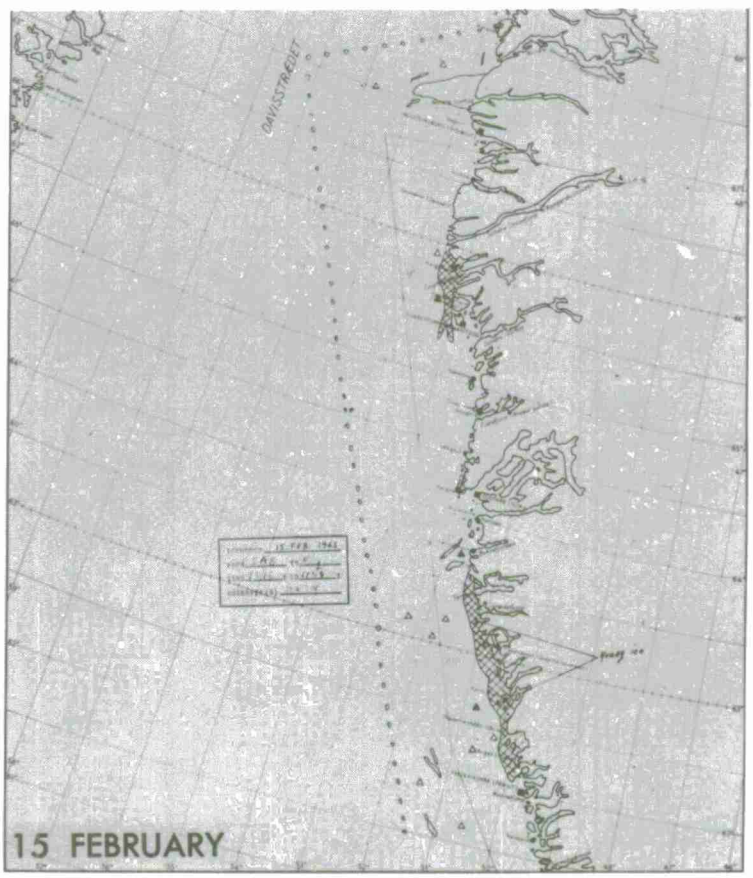
27 JANUARY

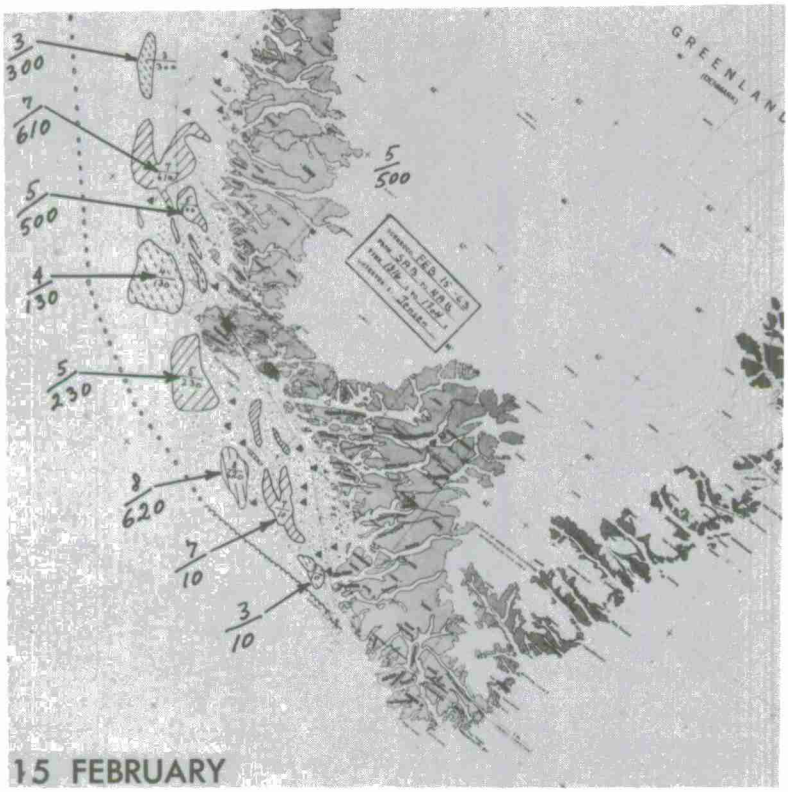

3 FEB 1962
1550 to 2043
ERICHSEN
9/10
9/10
NOT OBSERVED
9/630
5/10
3/300
9/630
8/620
9/810
4/400
9/720
3/300
9/630
NOT OBSERVED
3 FEBRUARY



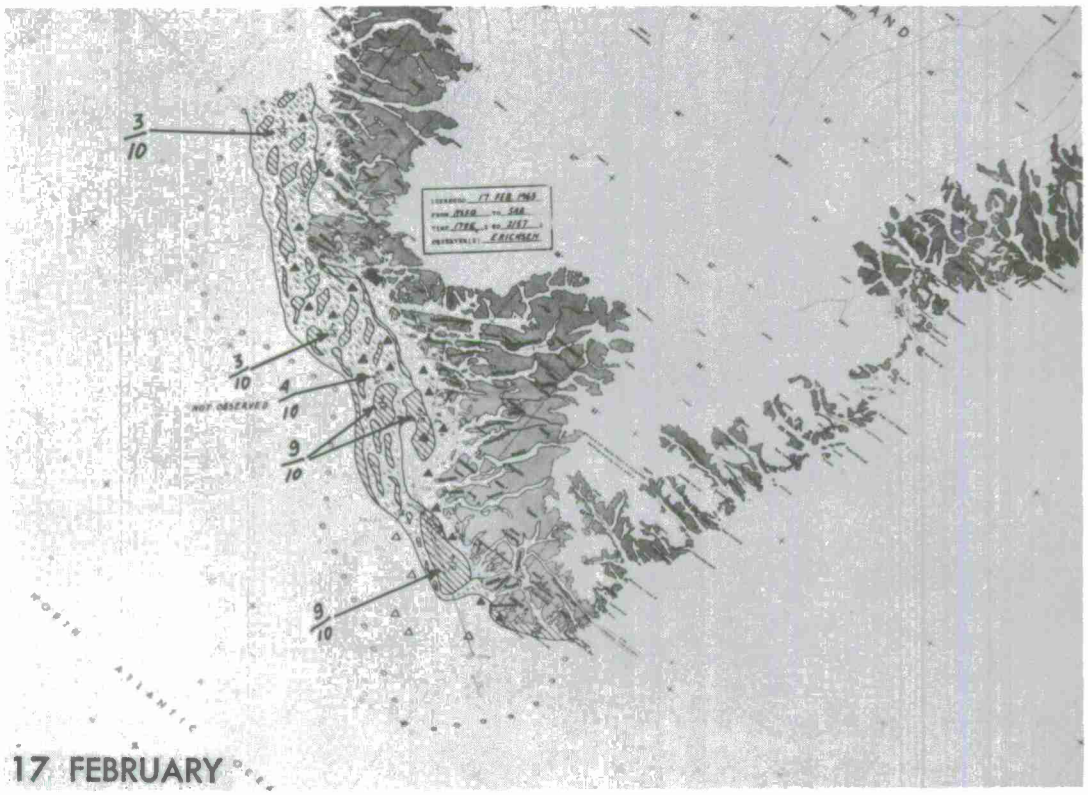
13 FEBRUARY


DAVISSTRAEDET
14 FEBRUARY

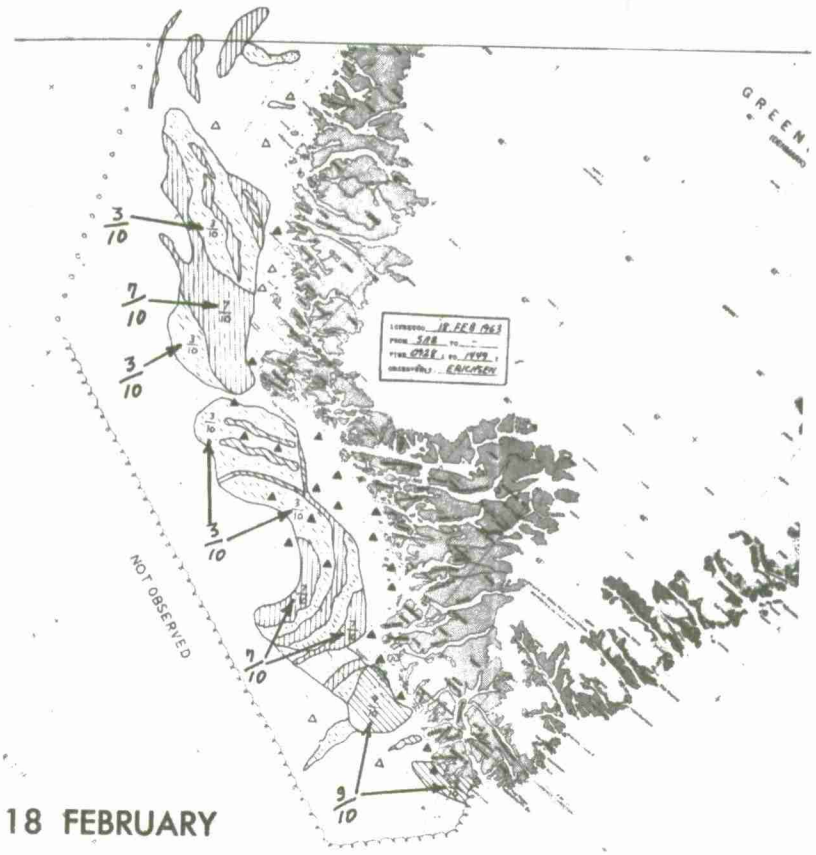

DAVISSTRAEDET
15 FEBRUARY



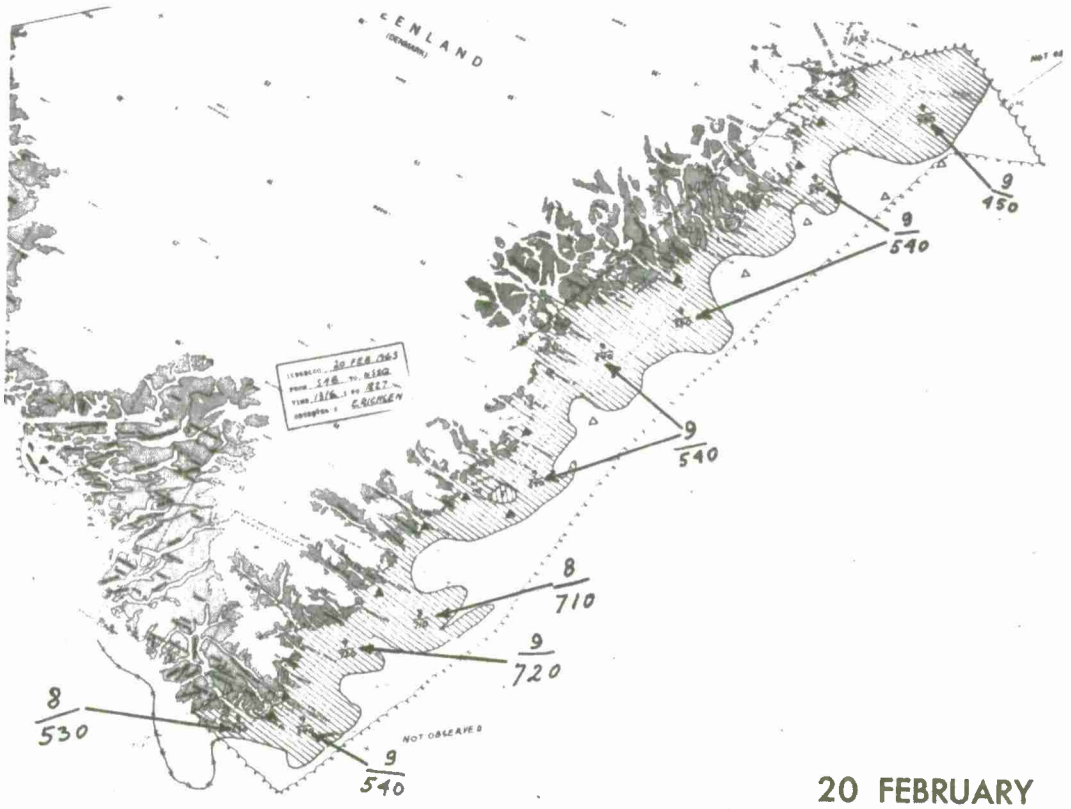
15 FEBRUARY



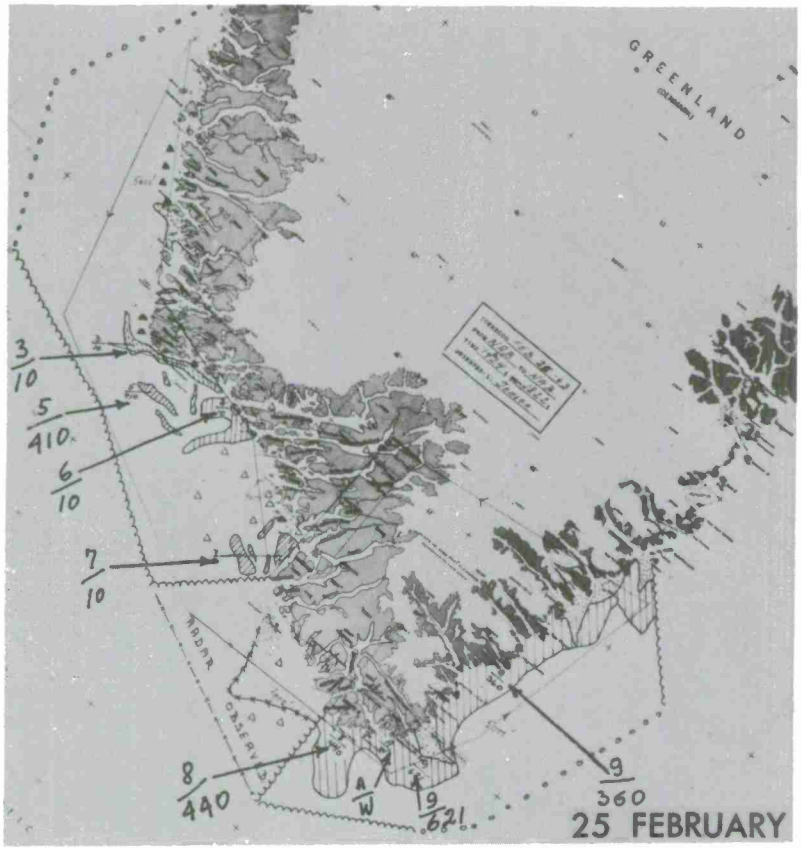
17 FEBRUARY

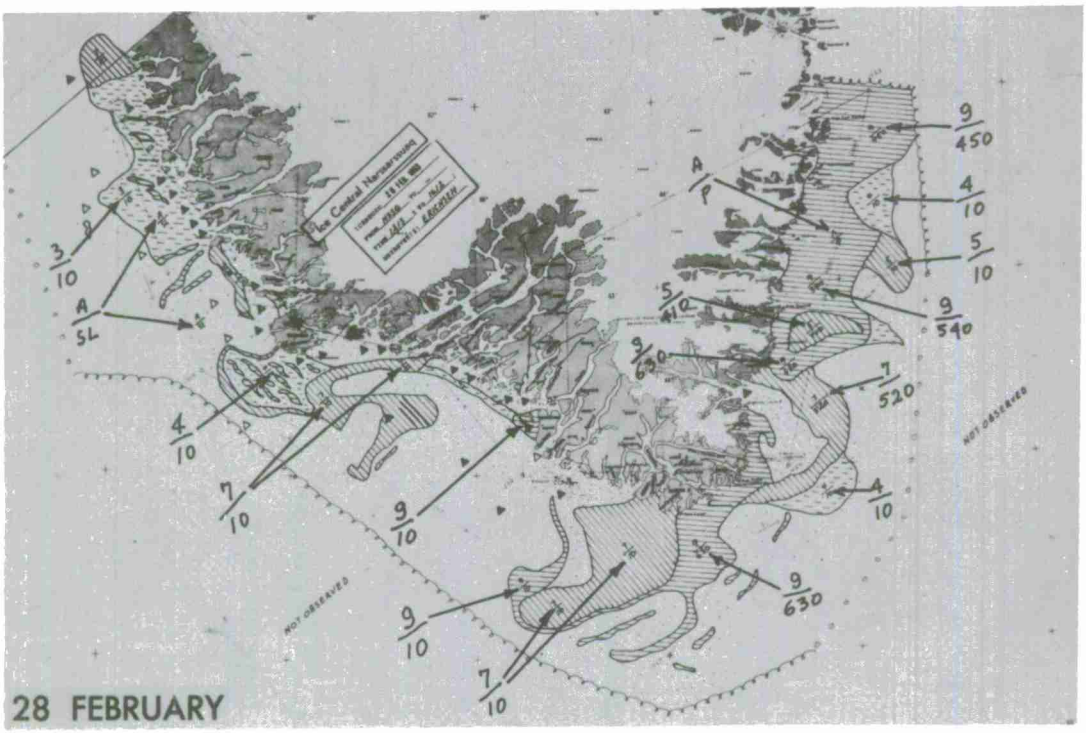


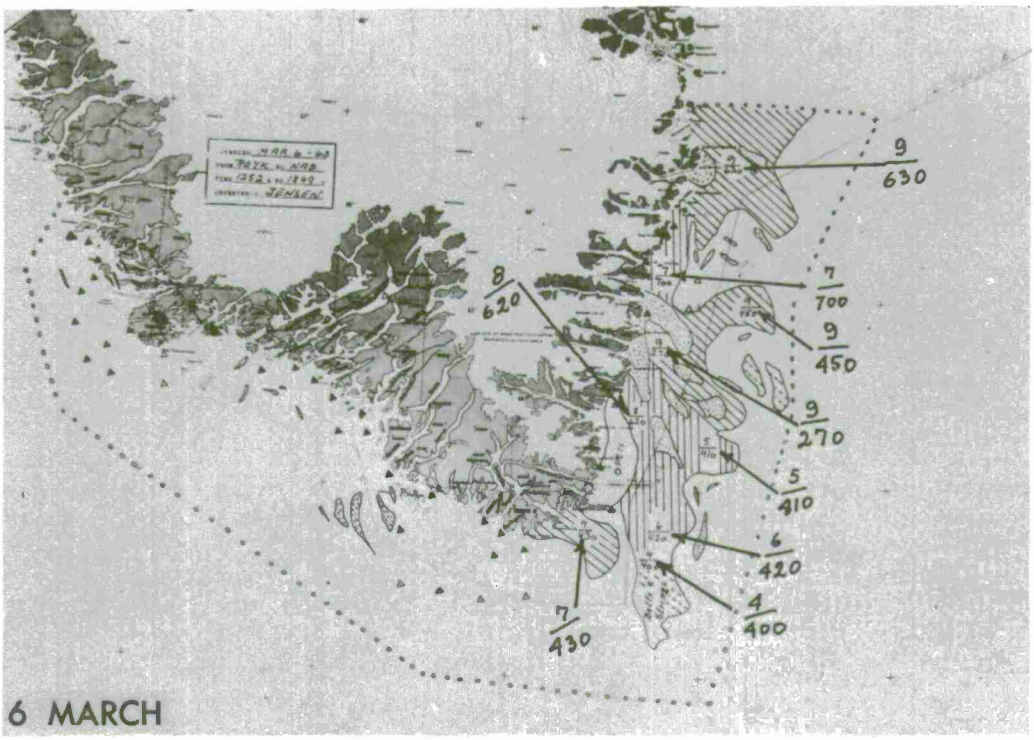
18 FEBRUARY



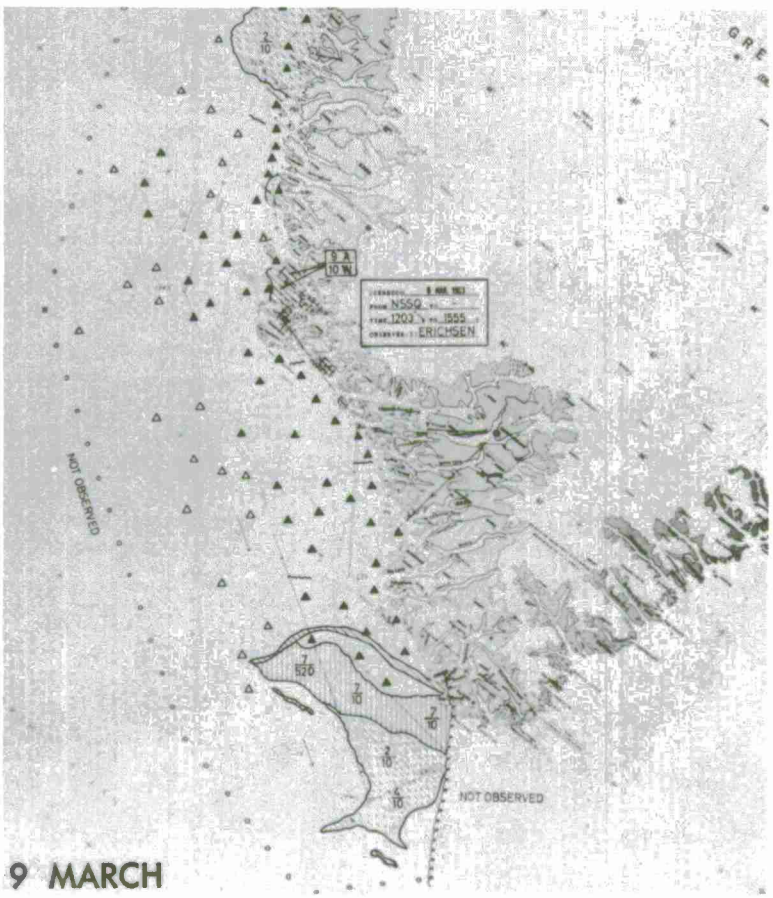
20 FEBRUARY


GREENLAND
3/10
5/410
6/10
7/10
8/440
A/W
9/621
9/360
RADAR OBSERV
25 FEBRUARY

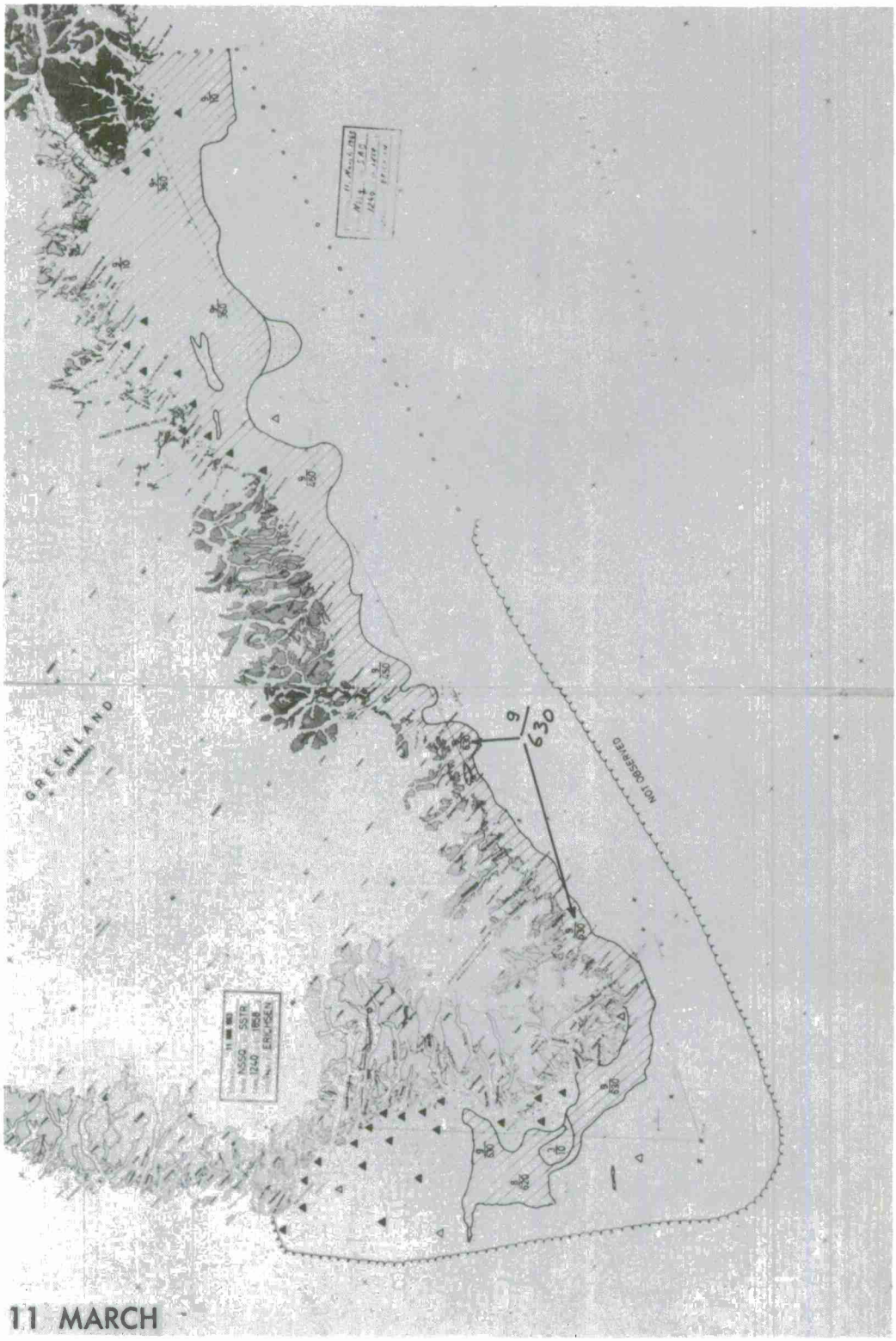

3/10
A/SL
4/10
7/10
9/10
9/10
7/10
9/450
A/P
4/10
5/10
5/410
9/540
9/630
7/520
4/10
9/630
NOT OBSERVED
NOT OBSERVED
28 FEBRUARY



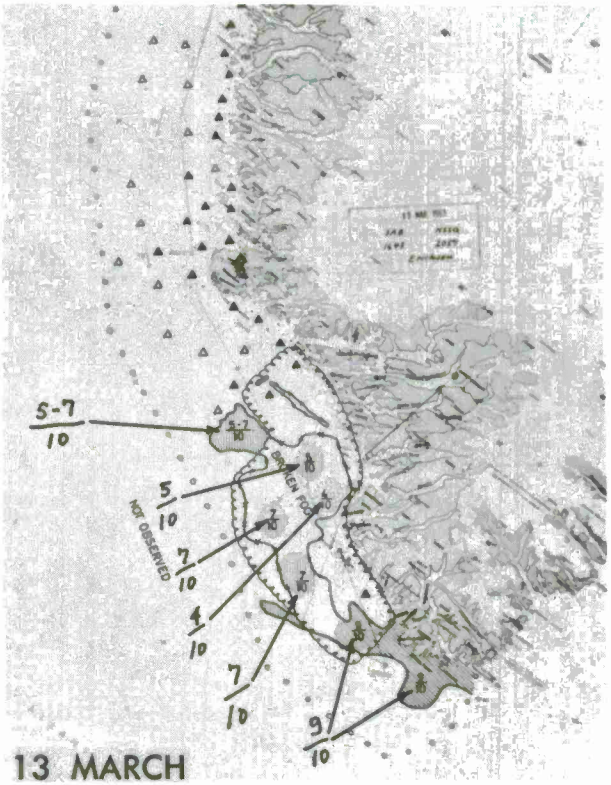
6 MARCH



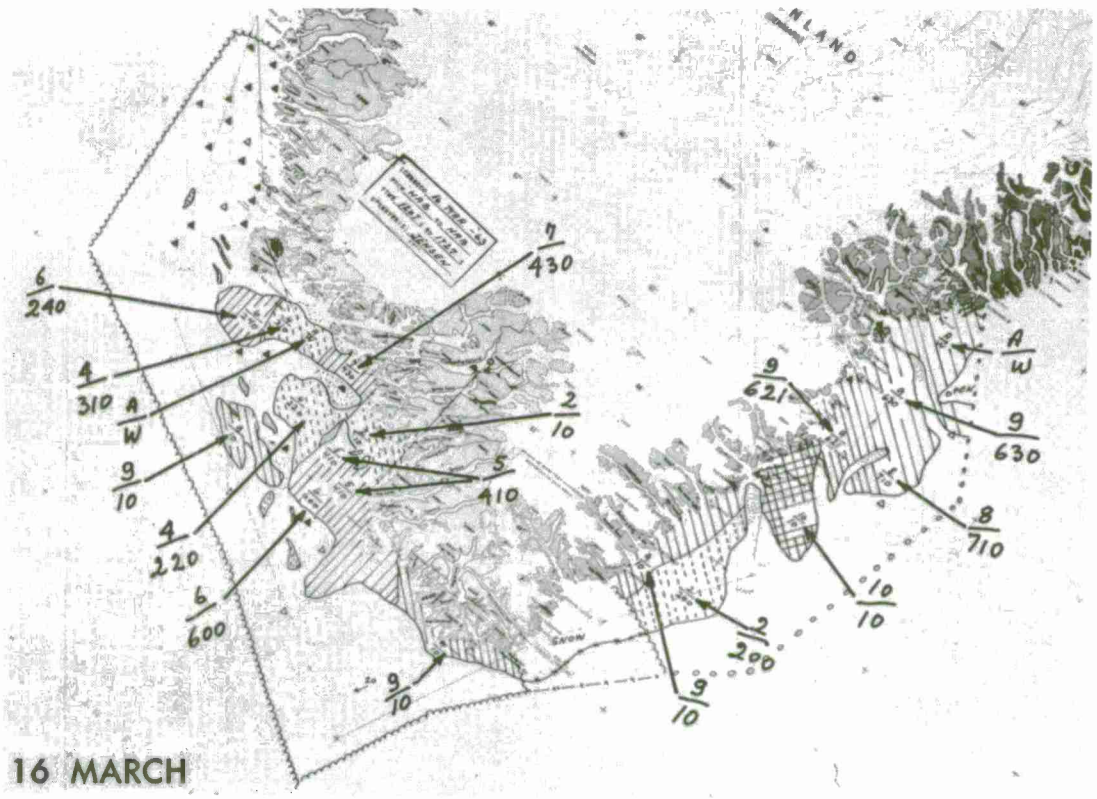
9 MARCH



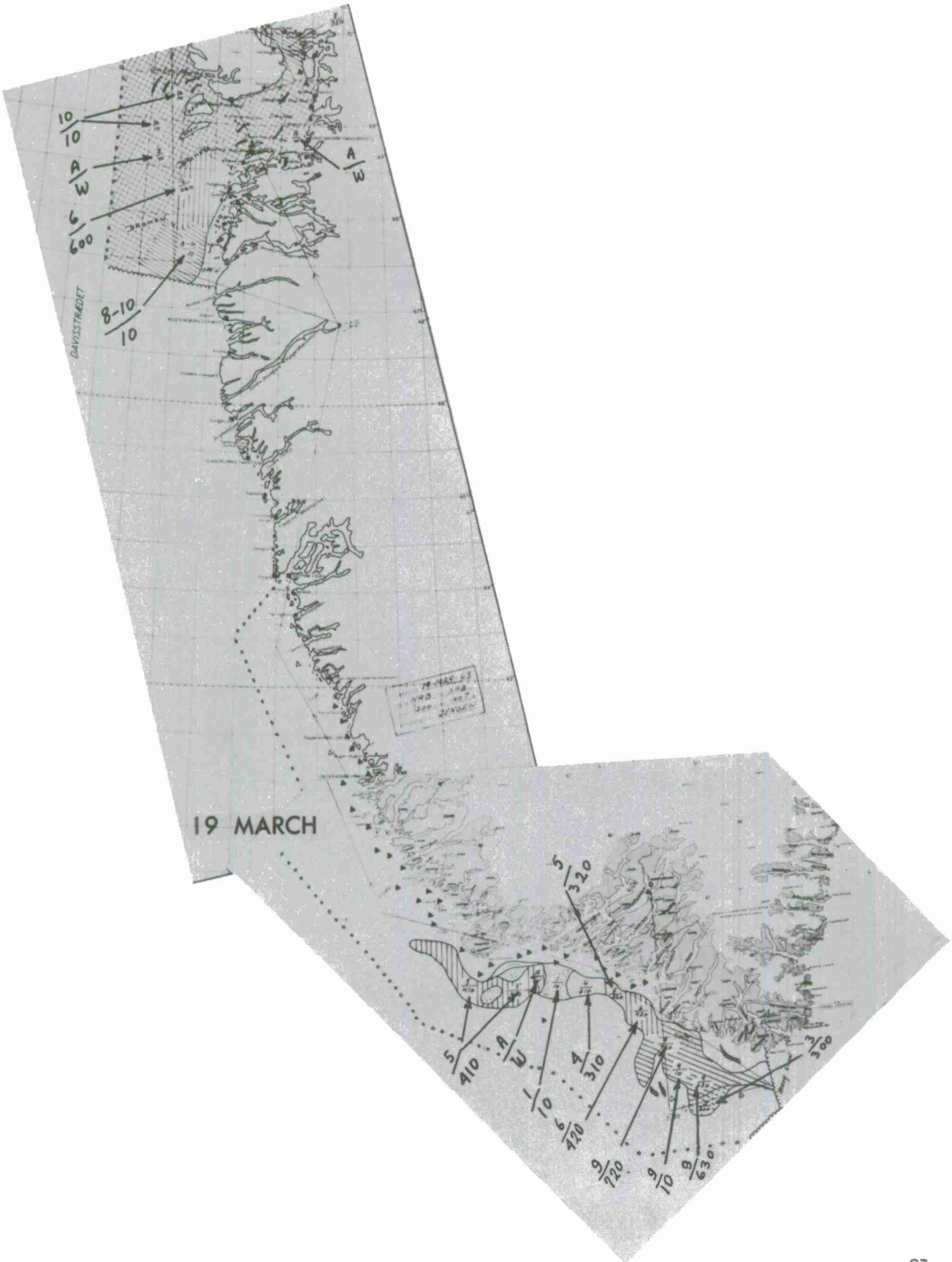
11 MARCH

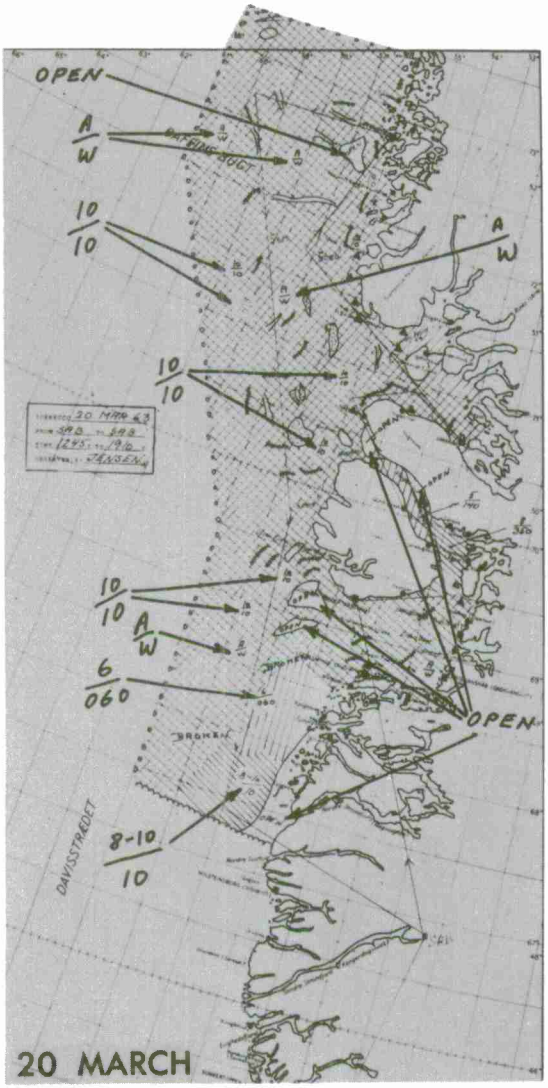


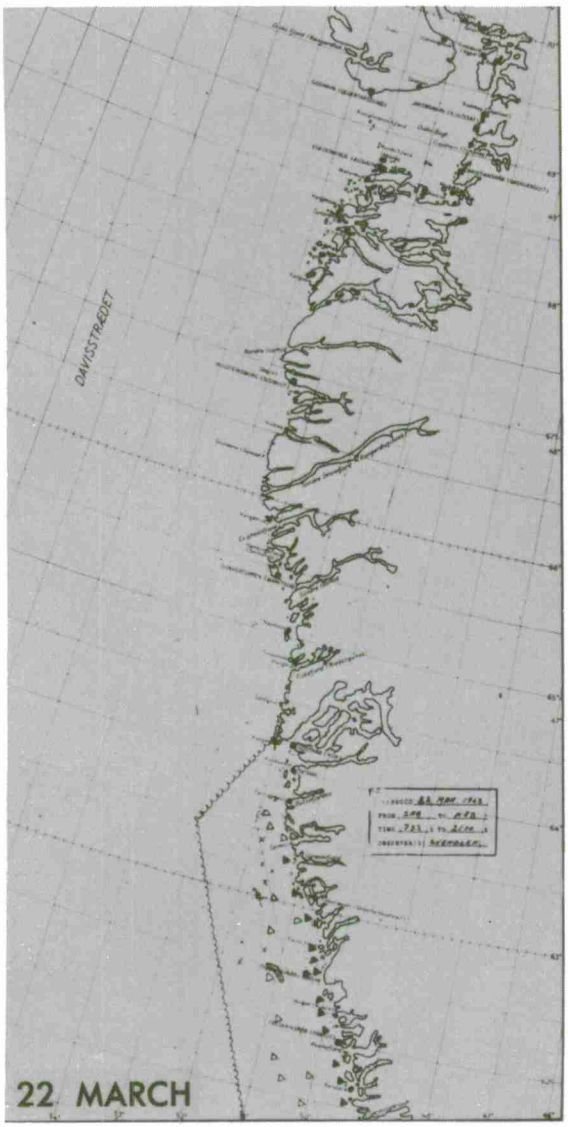
13 MARCH

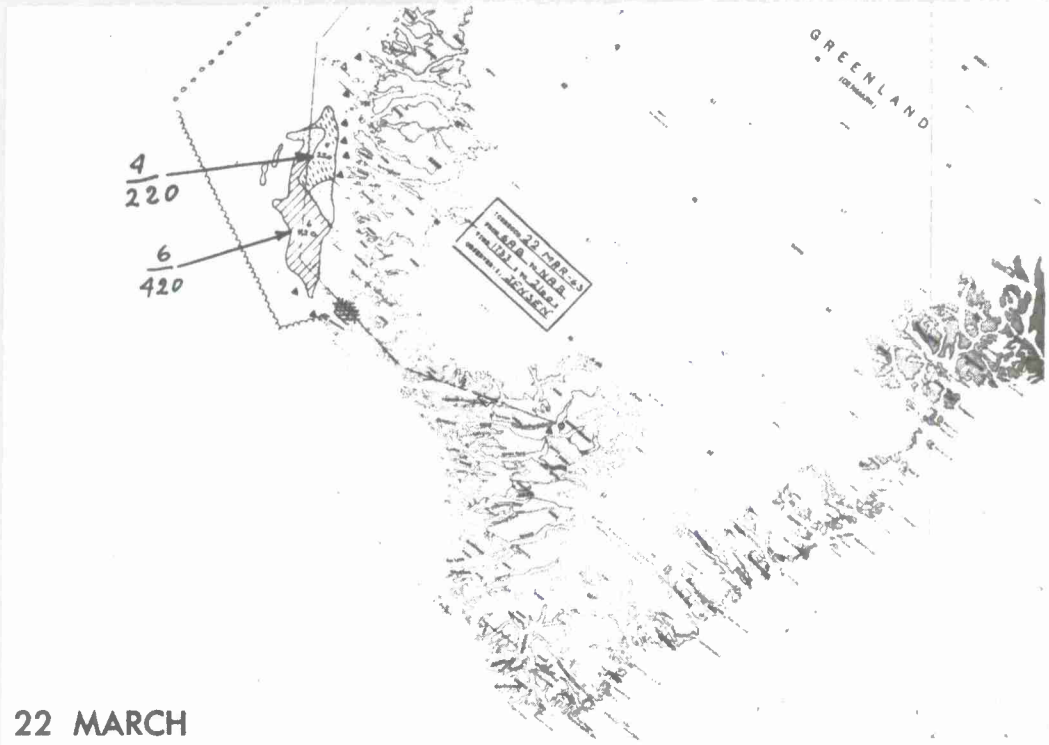


16 MARCH

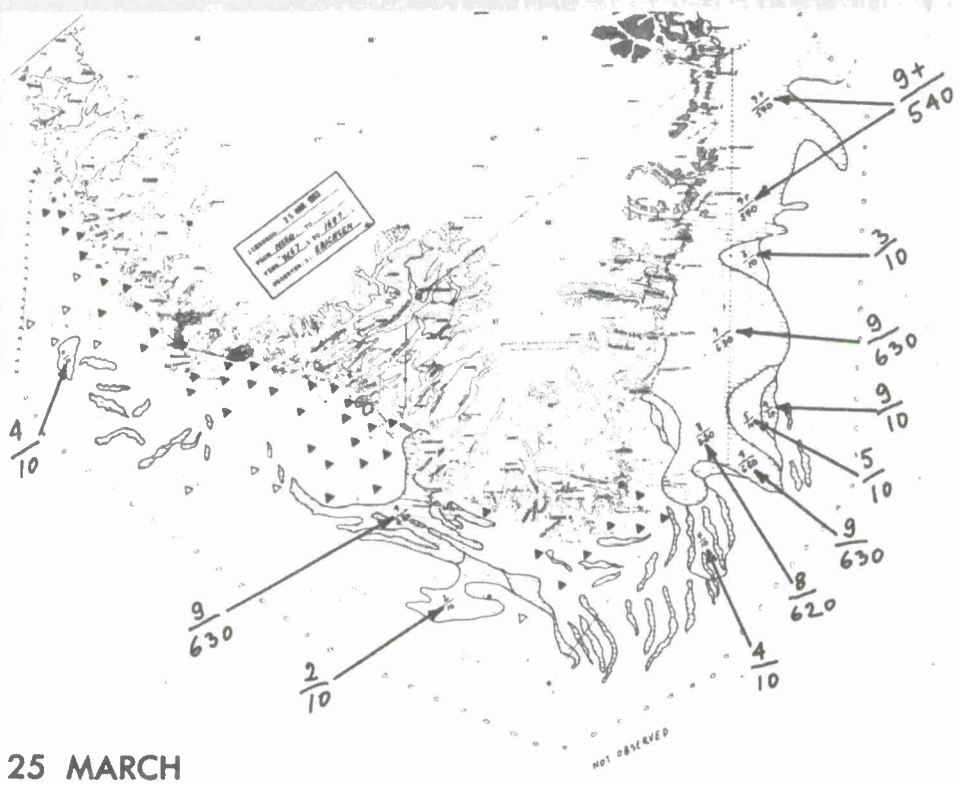

DAVISSTRAEDET
19 MARCH


OPEN
A/W
10/10
A/W
10/10
10/10
A/W
6/060
OPEN
8-10/10
DAVISSTRAEDET
20 MARCH

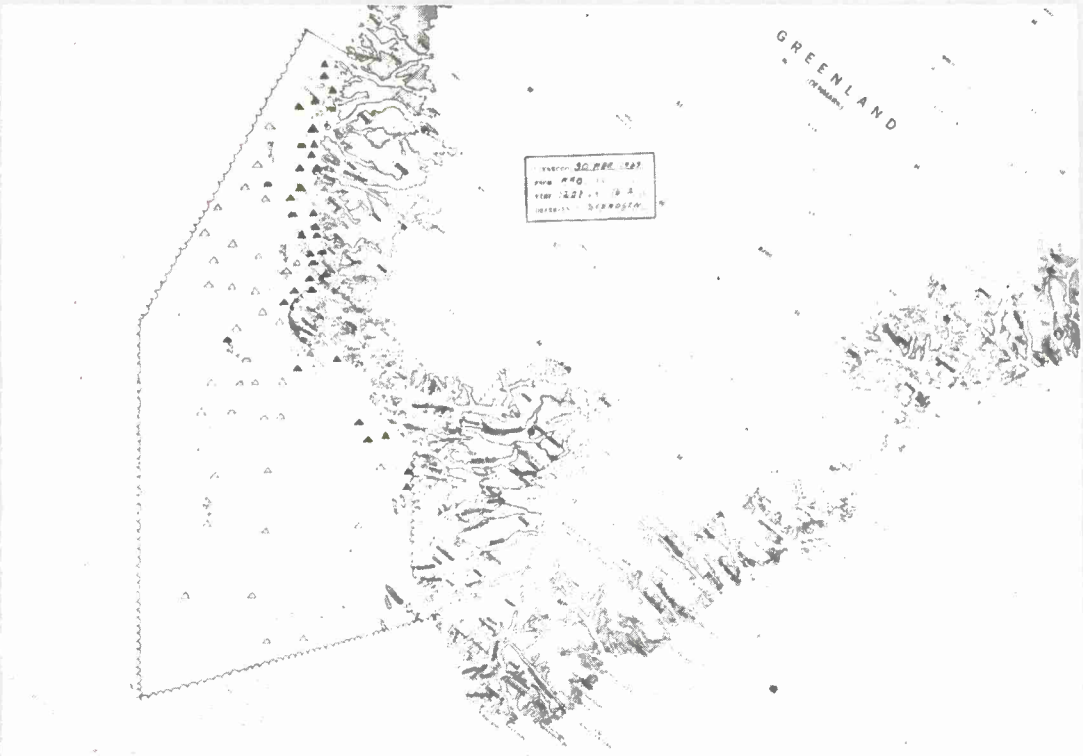

DAVISSTRAEDET
22 MARCH



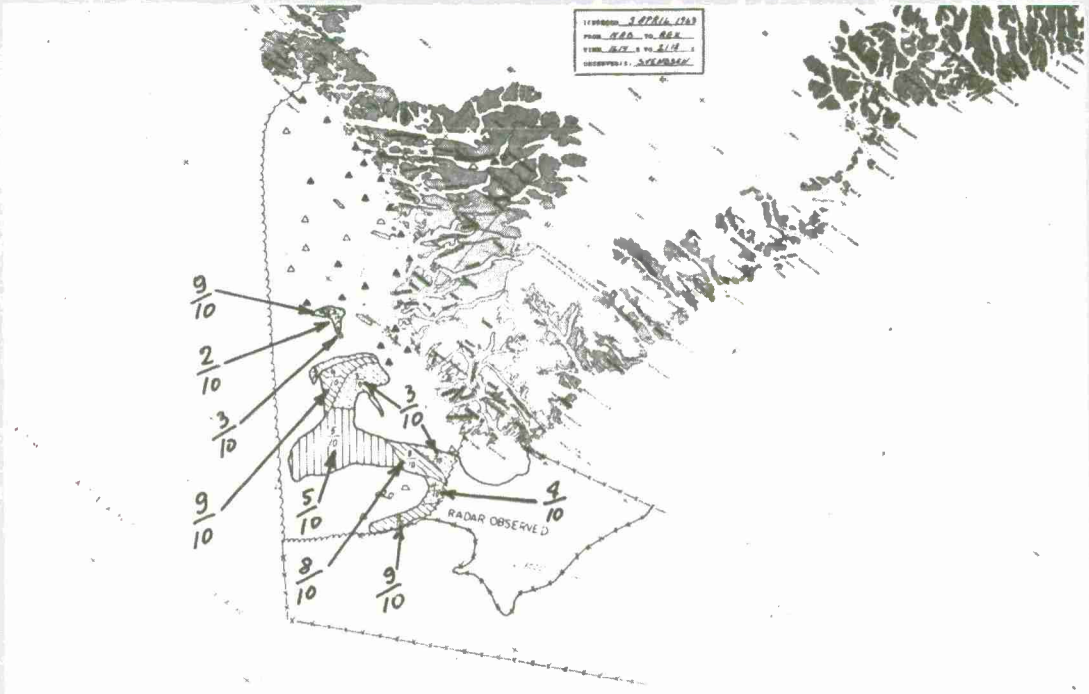
22 MARCH



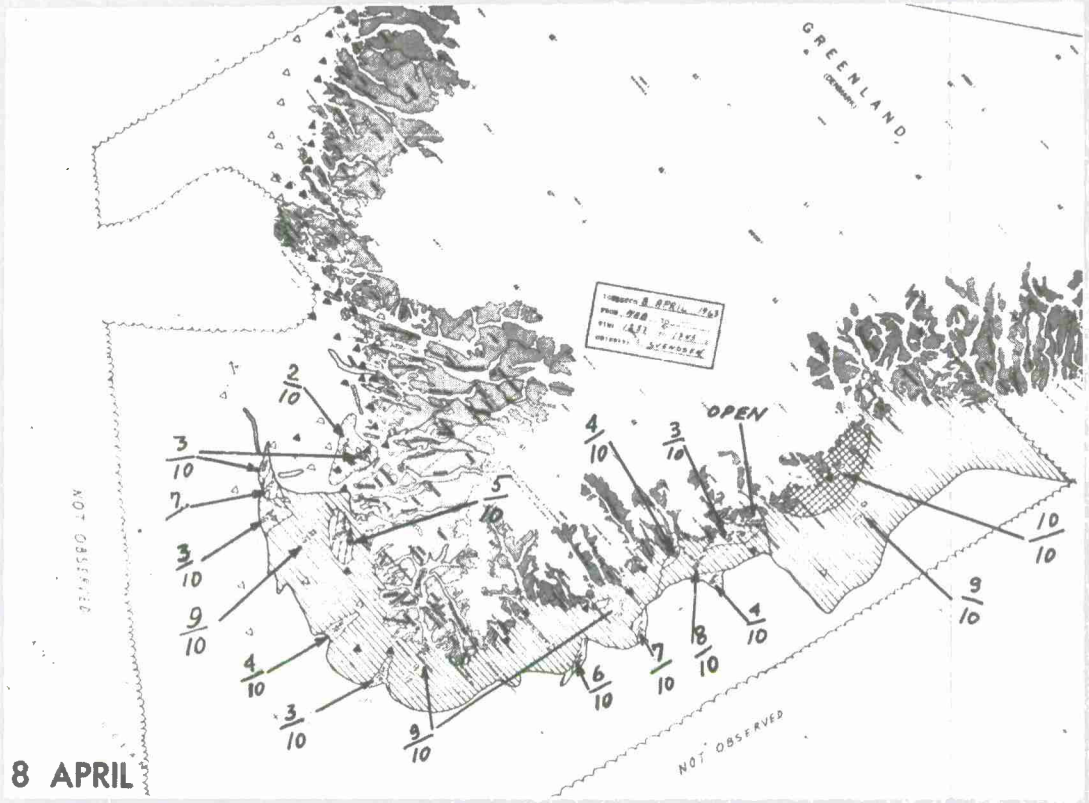
25 MARCH



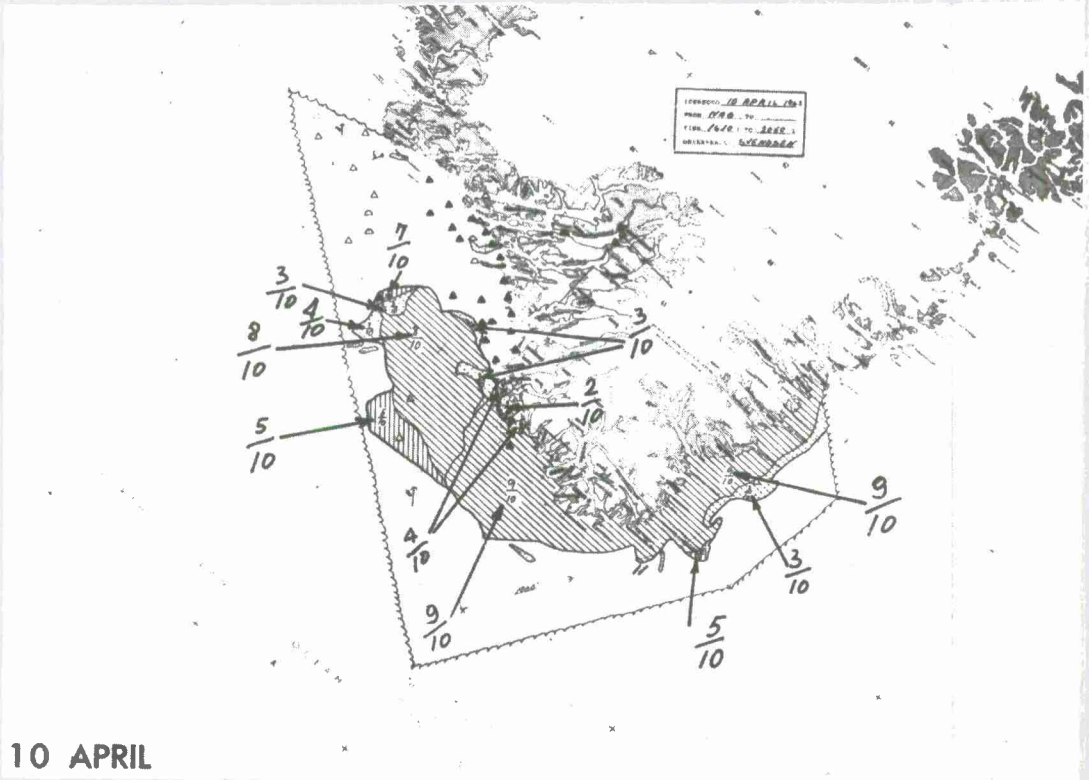
30 MARCH



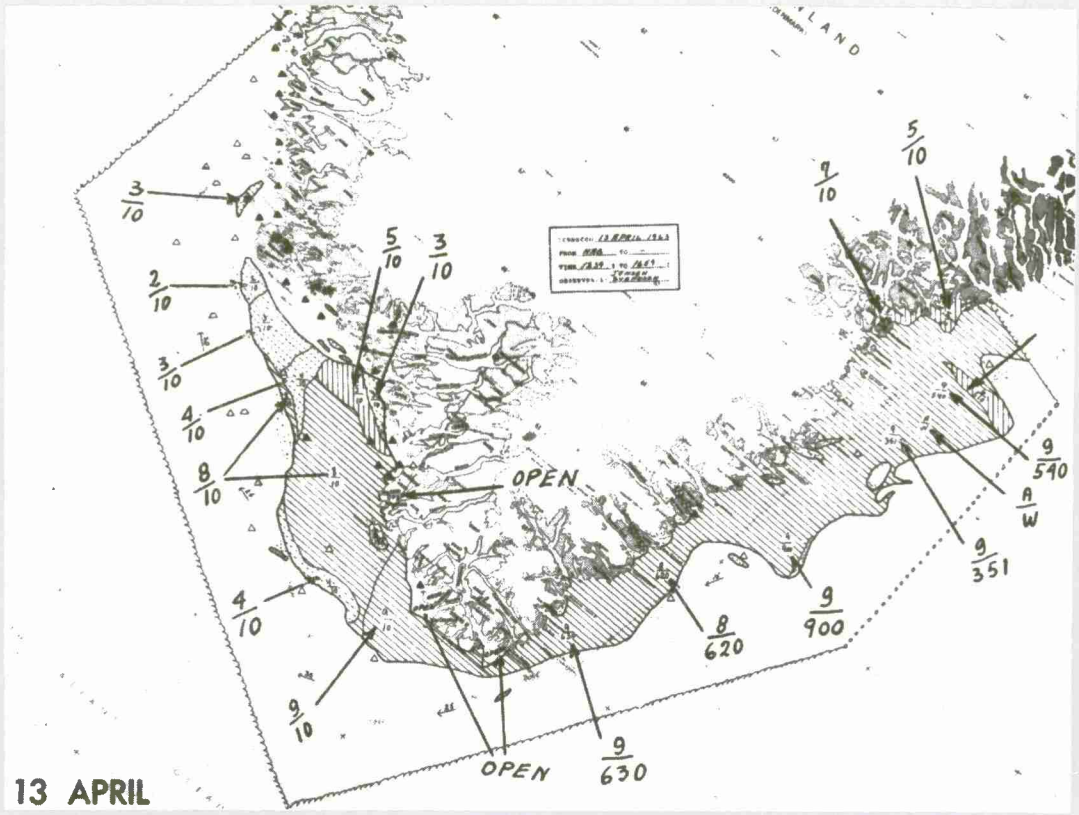
3 APRIL



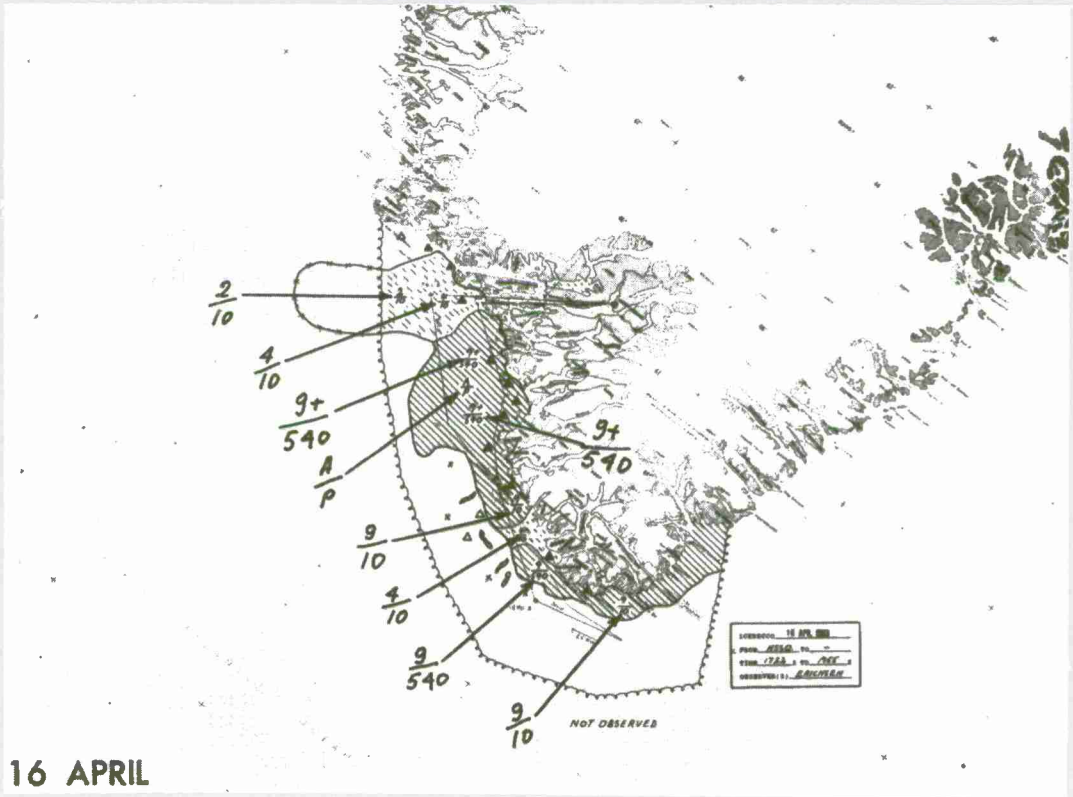
8 APRIL



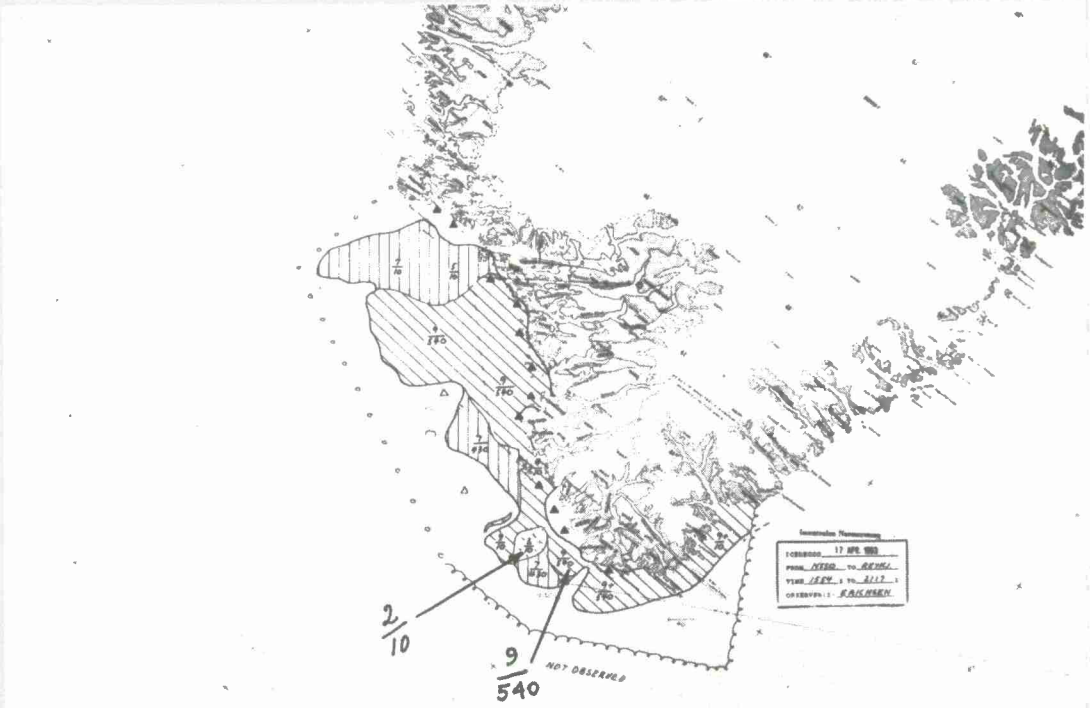
10 APRIL



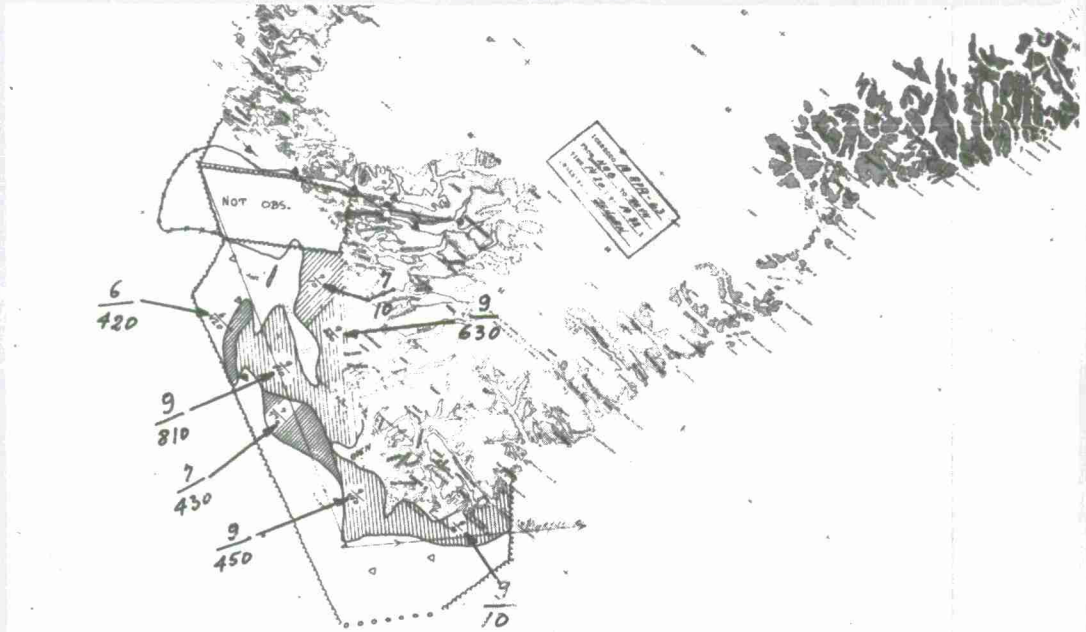
13 APRIL



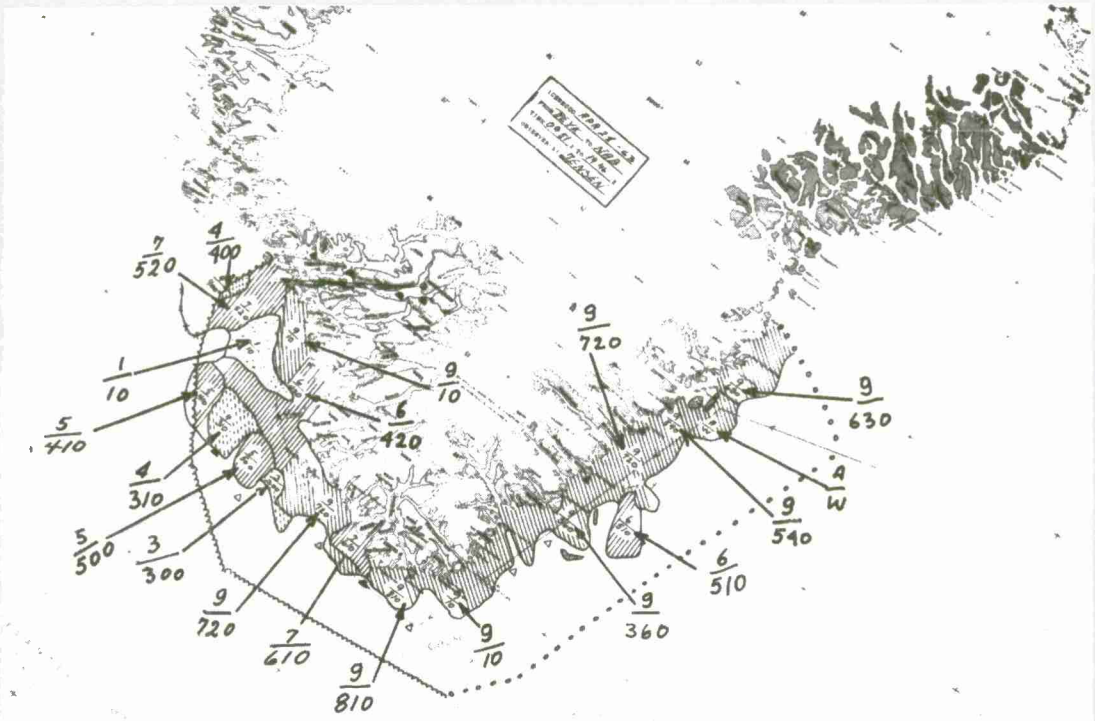
16 APRIL



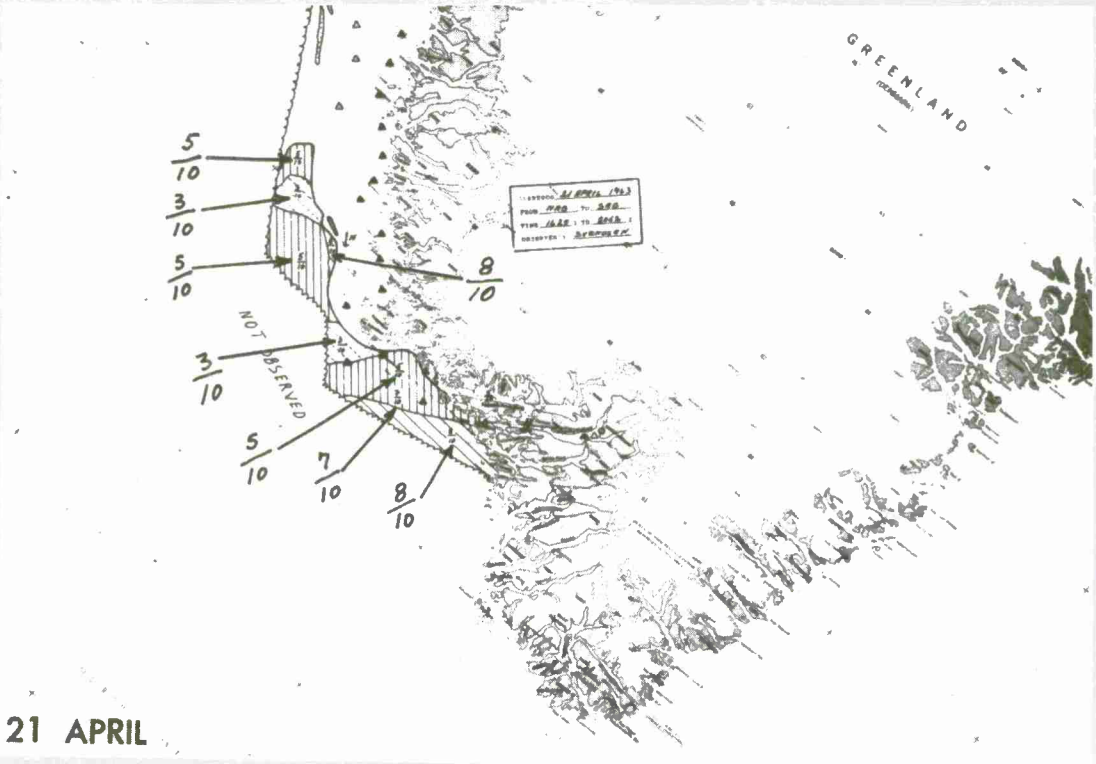
17 APRIL



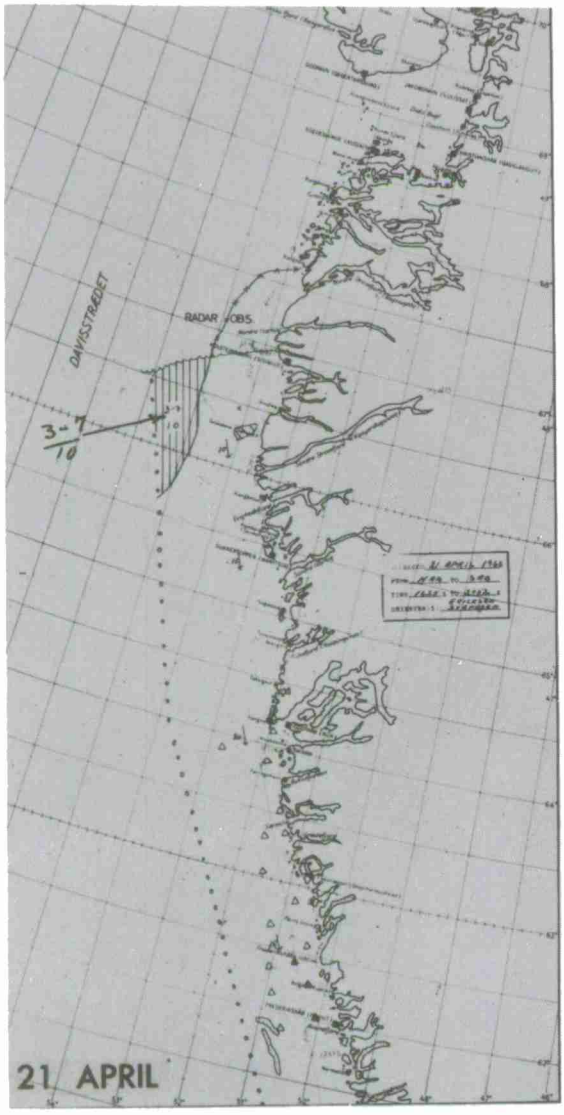
19 APRIL

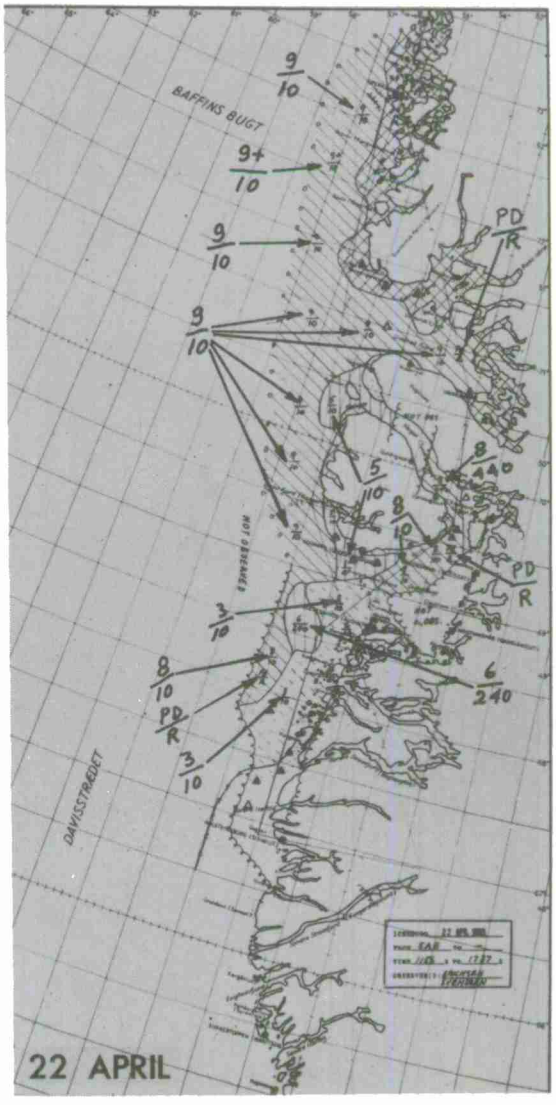


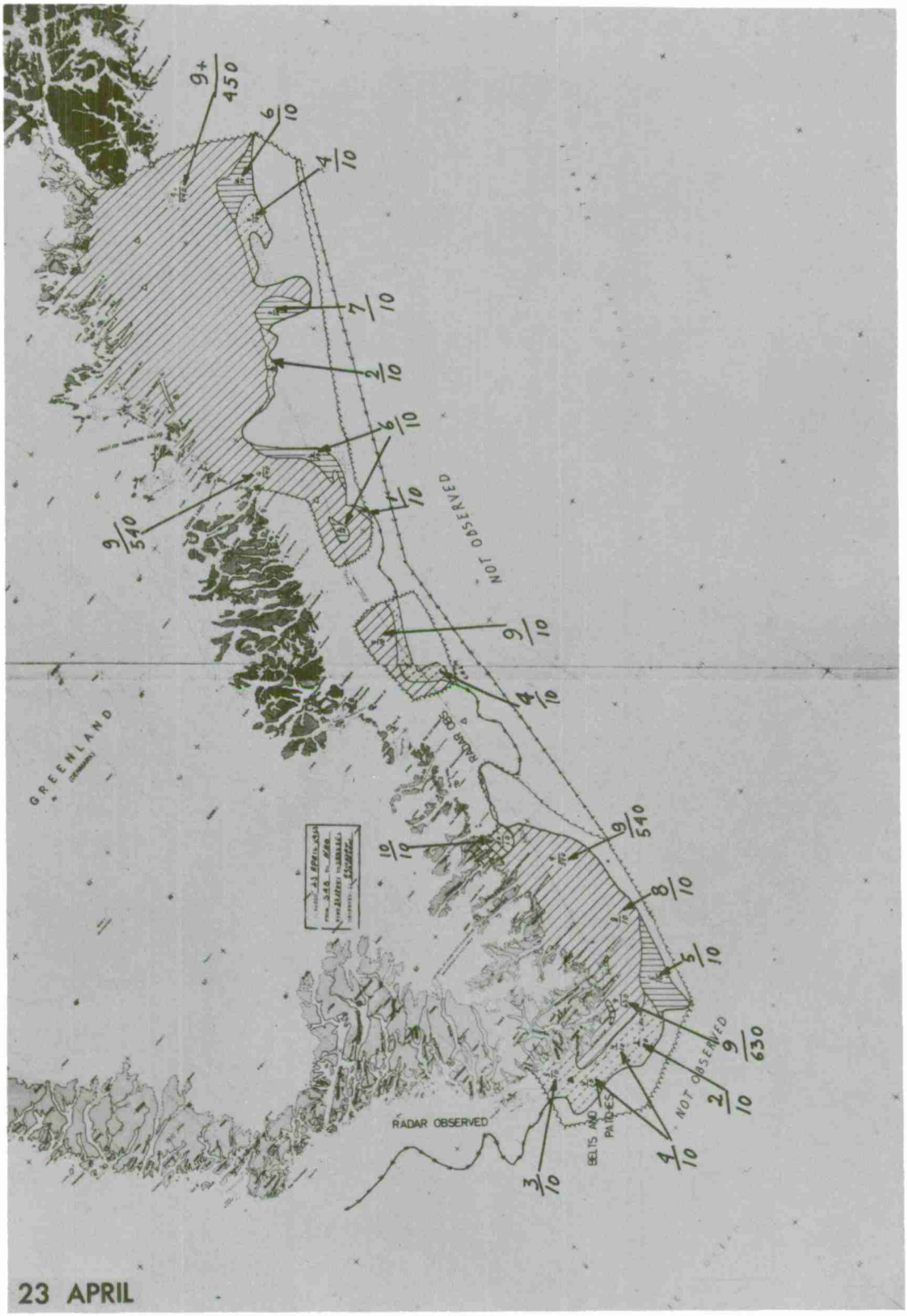
21 APRIL

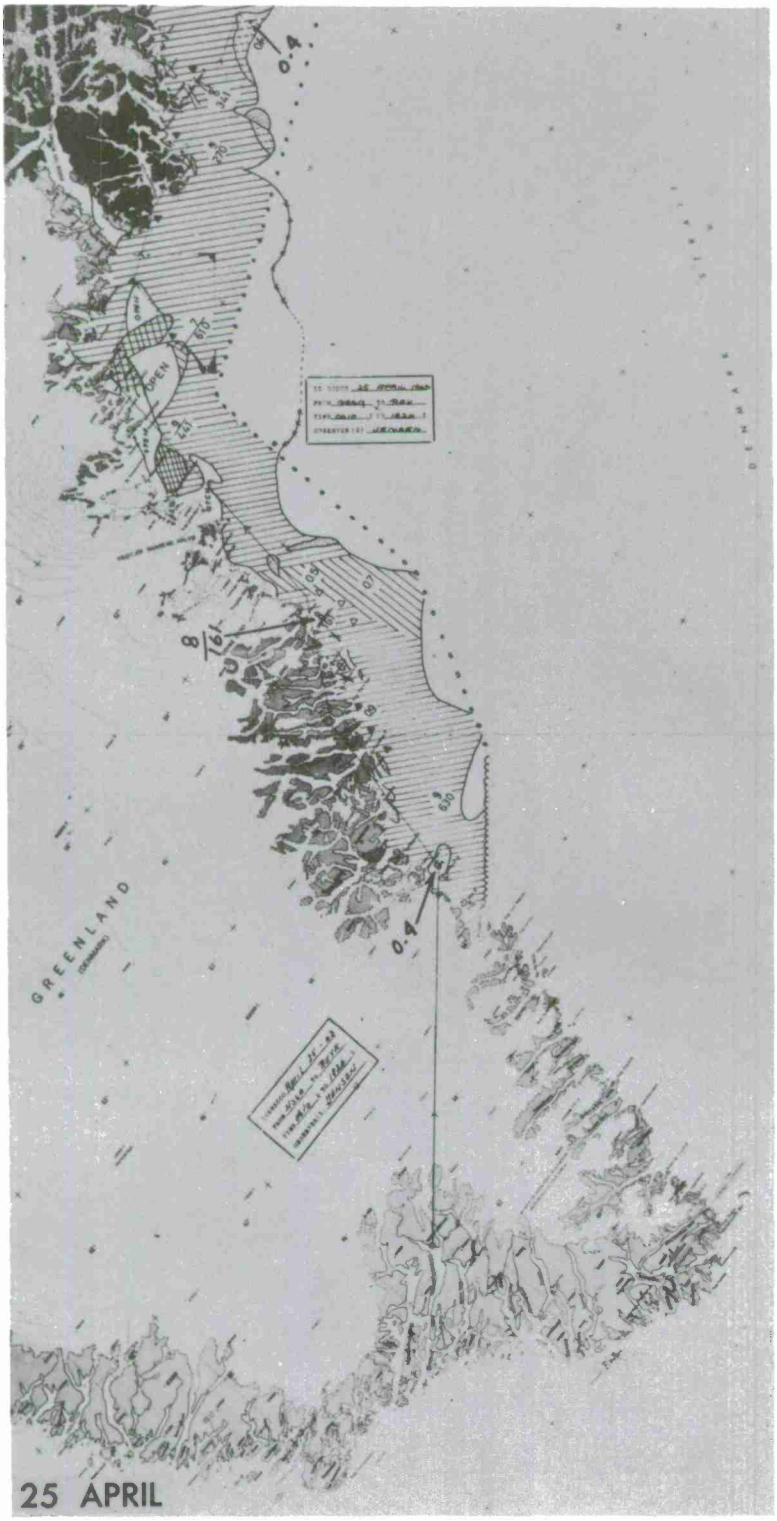


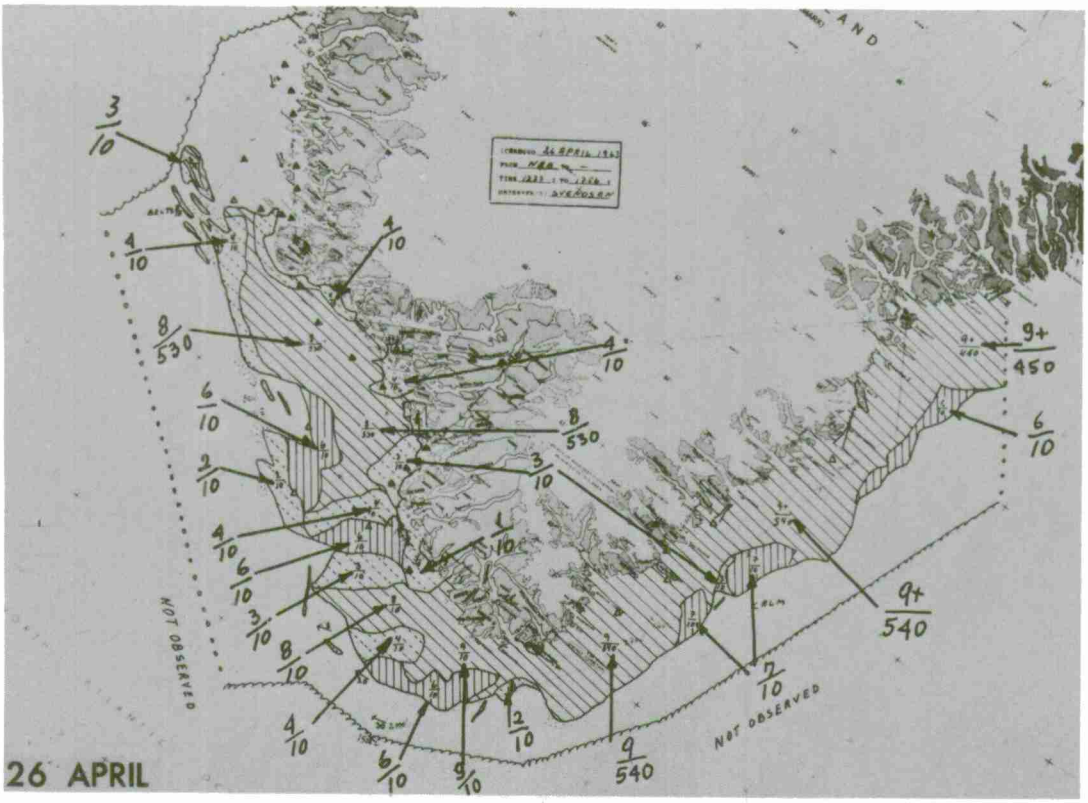
21 APRIL

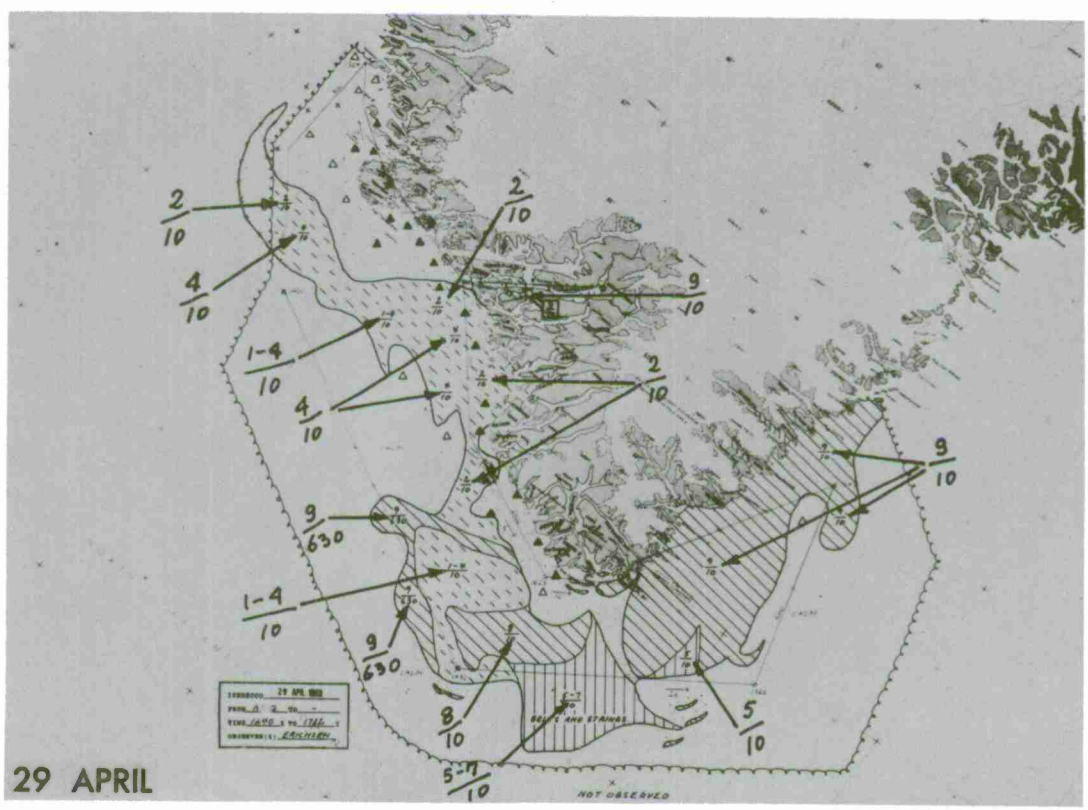

DAVISSTRÆDET
RADAR OBS.
3-7/10
21 APRIL

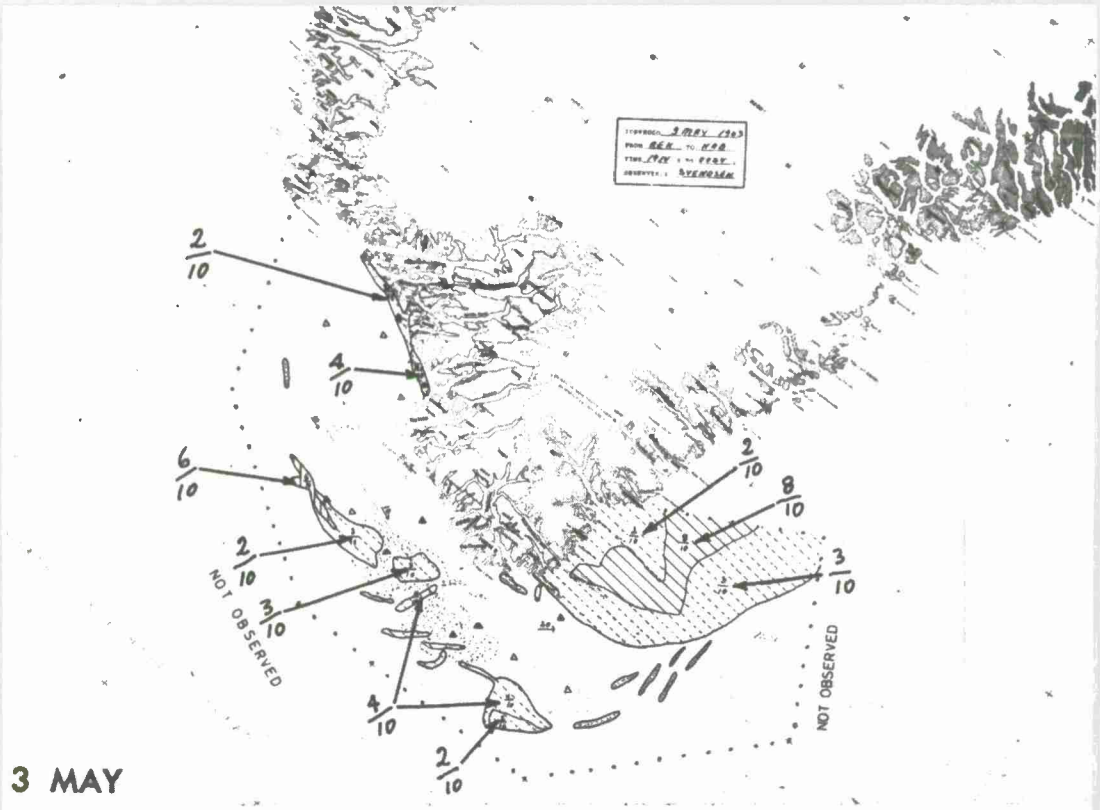

BAFFINS BUGT
9/10
9+/10
9/10
PD/R
9/10
8/440
5/10
8/10
PD/R
3/10
8/10
PD/R
3/10
6/240
DAVISSTRÆDET
22 APRIL


9+/450
6/10
4/10
7/10
2/10
6/10
7/10
9/540
9/10
4/10
GREENLAND
NOT OBSERVED
RADAR OBS
10/10
9/540
8/10
5/10
9/630
2/10
4/10
3/10
RADAR OBSERVED
BELTS AND PATCHES
NOT OBSERVED
23 APRIL

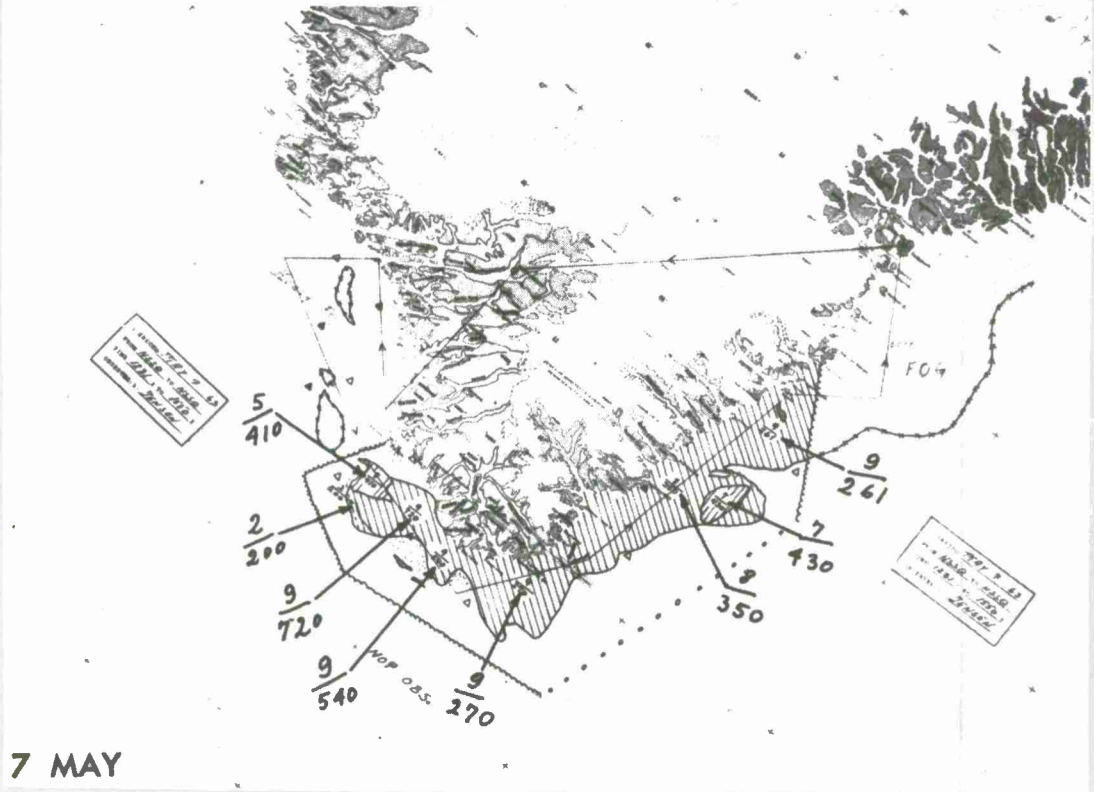

GREENLAND
25 APRIL


NOT OBSERVED
NOT OBSERVED
26 APRIL

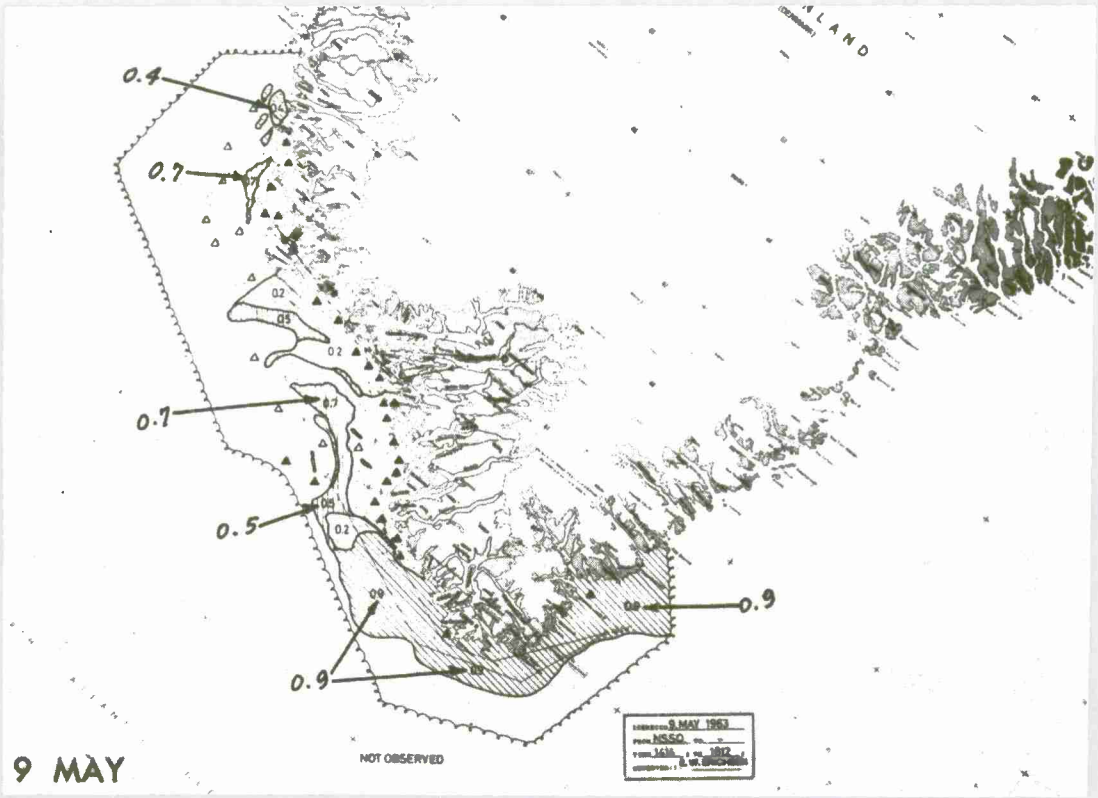

NOT OBSERVED
29 APRIL


2/10
4/10
6/10
2/10
3/10
NOT OBSERVED
4/10
2/10
2/10
8/10
3/10
NOT OBSERVED

3 MAY


5/410
2/200
9/720
9/540
WOP OBS.
9/270
9/261
7/430
8/350
FOY

7 MAY


0.4
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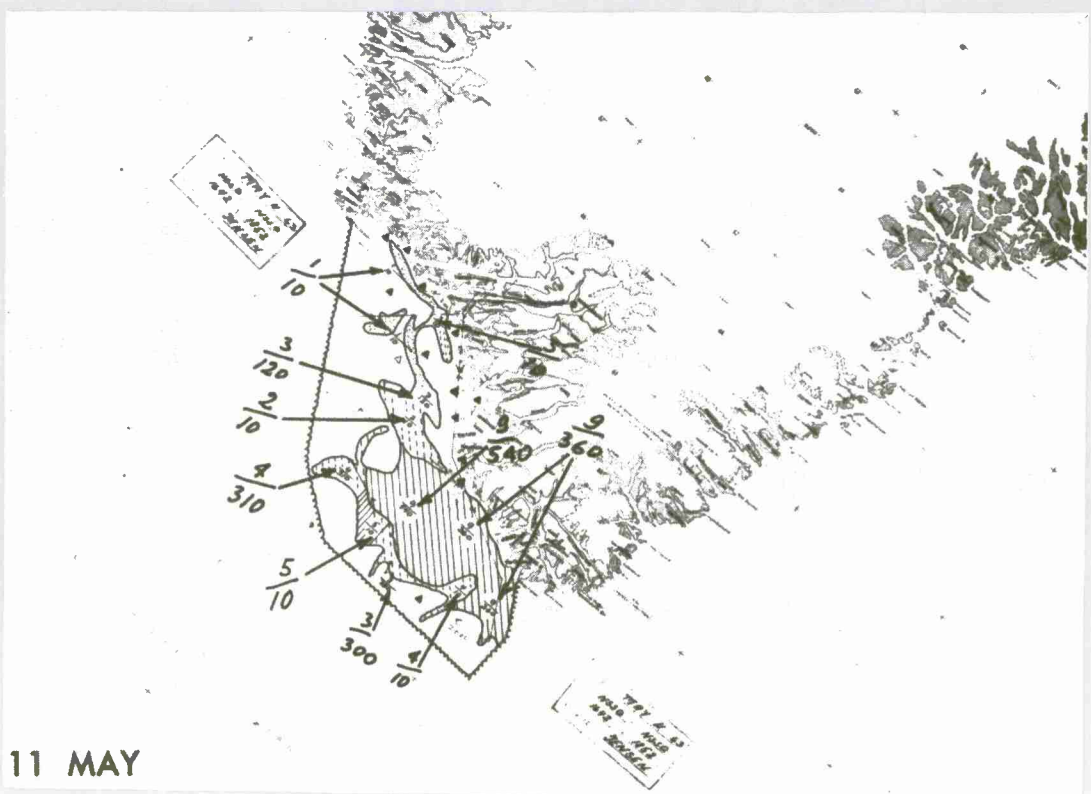
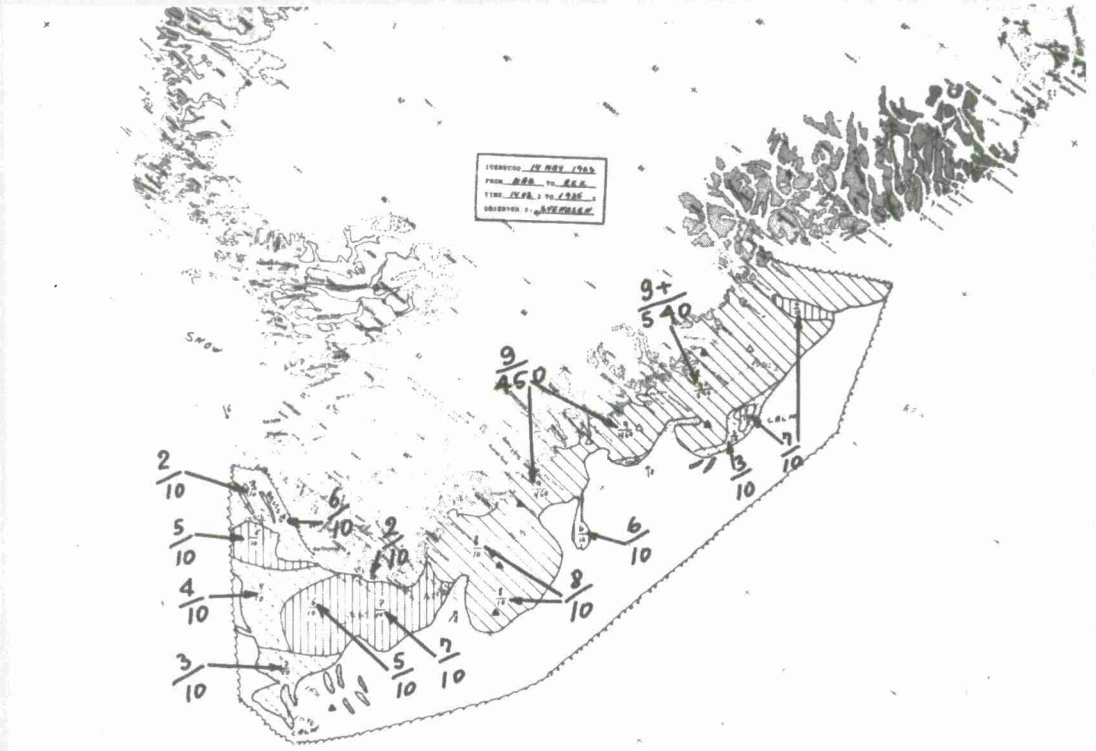
0.7
0.5
0.9
0.9
NOT OBSERVED
9 MAY 1963

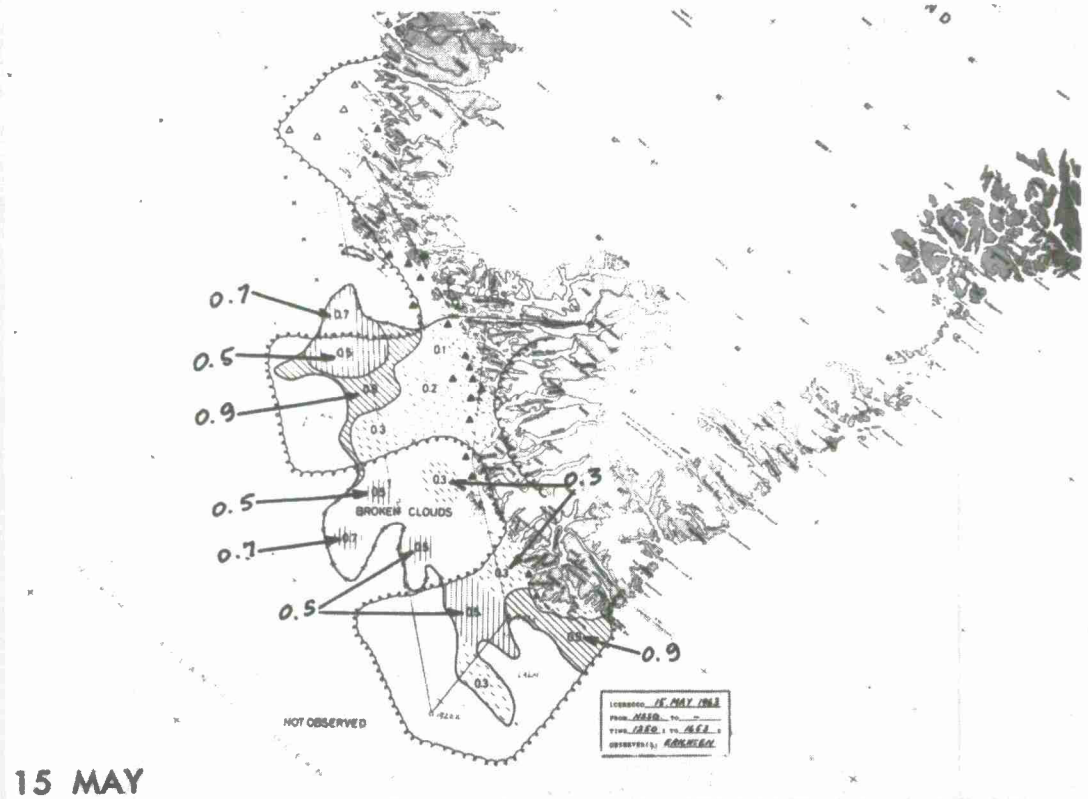
9 MAY


1/10
3/120
2/10
4/310
5/10
3/300
4/10
9/540
9/360

11 MAY


SNOW
9+/10
9/10
2/10
5/10
4/10
3/10
6/10
2/10
5/10
7/10
8/10
6/10
3/10
7/10

14 MAY


0.7
0.5
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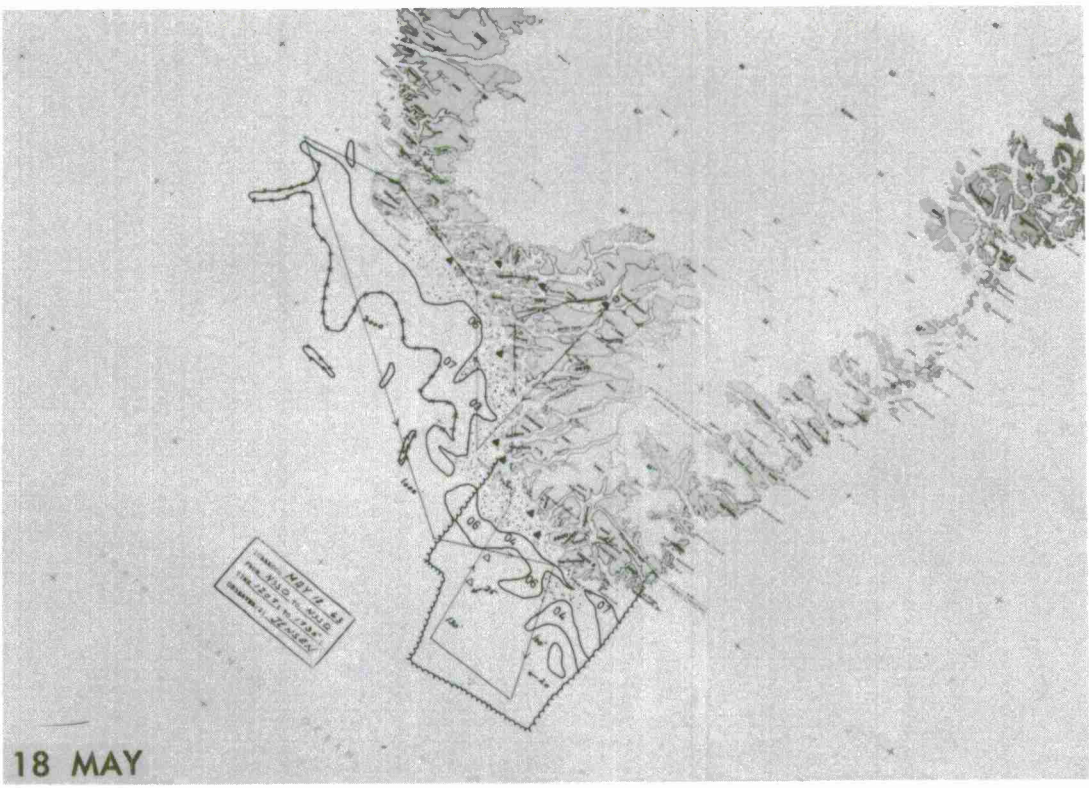
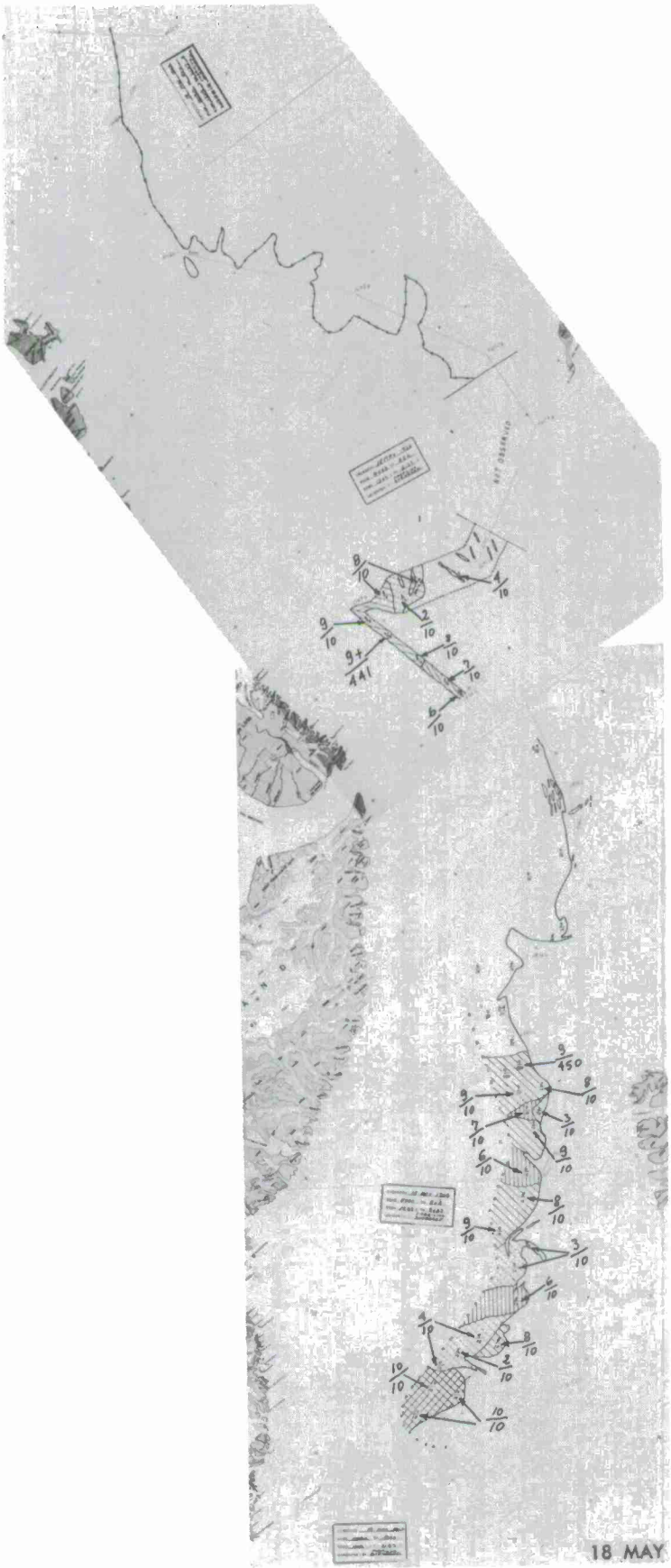
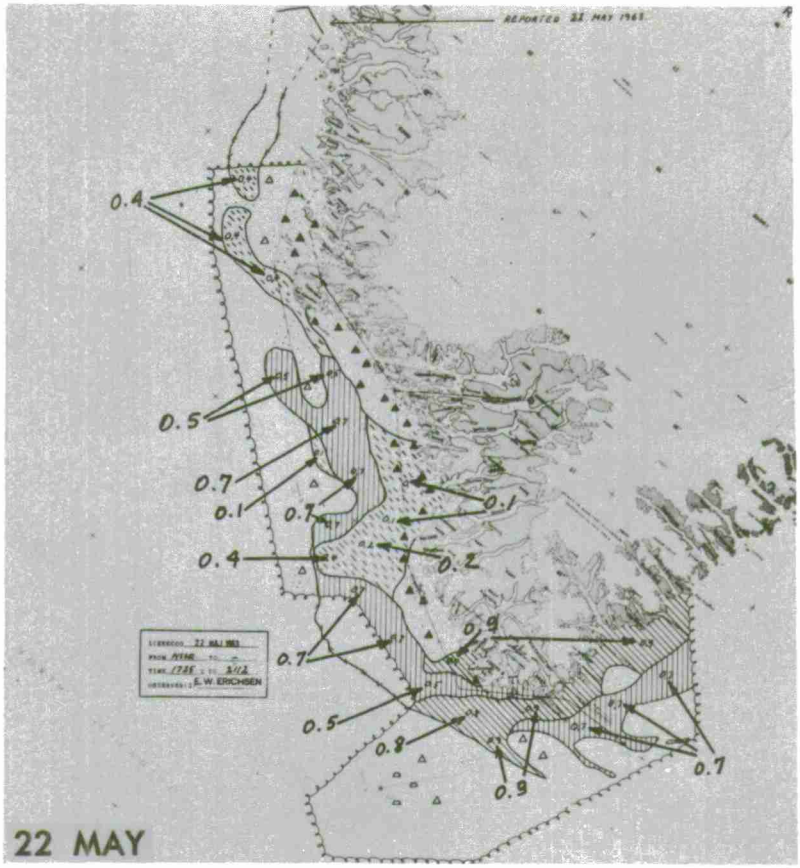
0.3
0.9
BROKEN CLOUDS
NOT OBSERVED

15 MAY


18 MAY


18 MAY


REPORTED 22 MAY 1963
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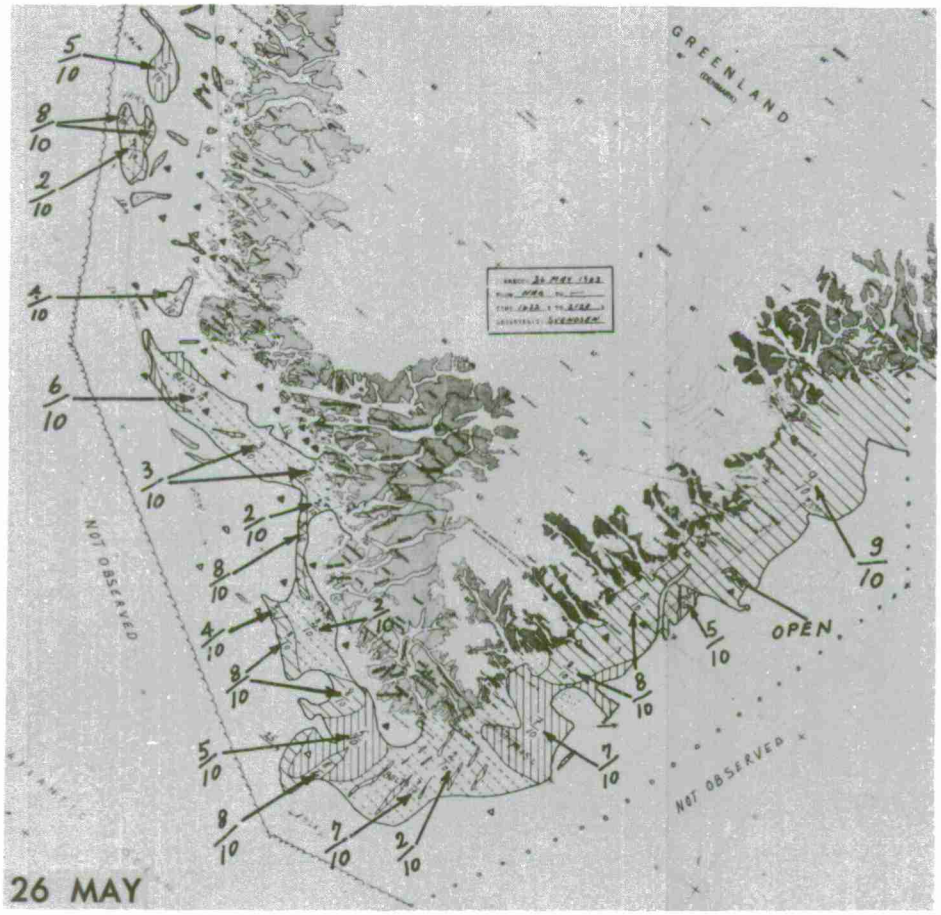
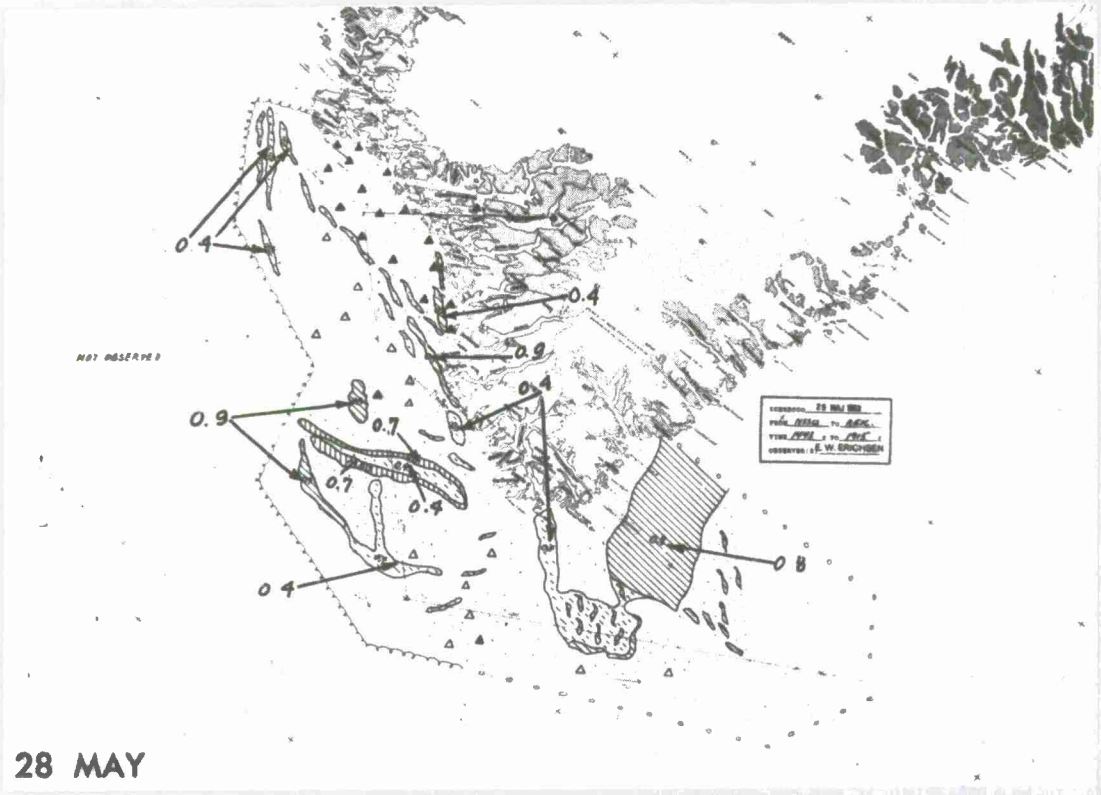
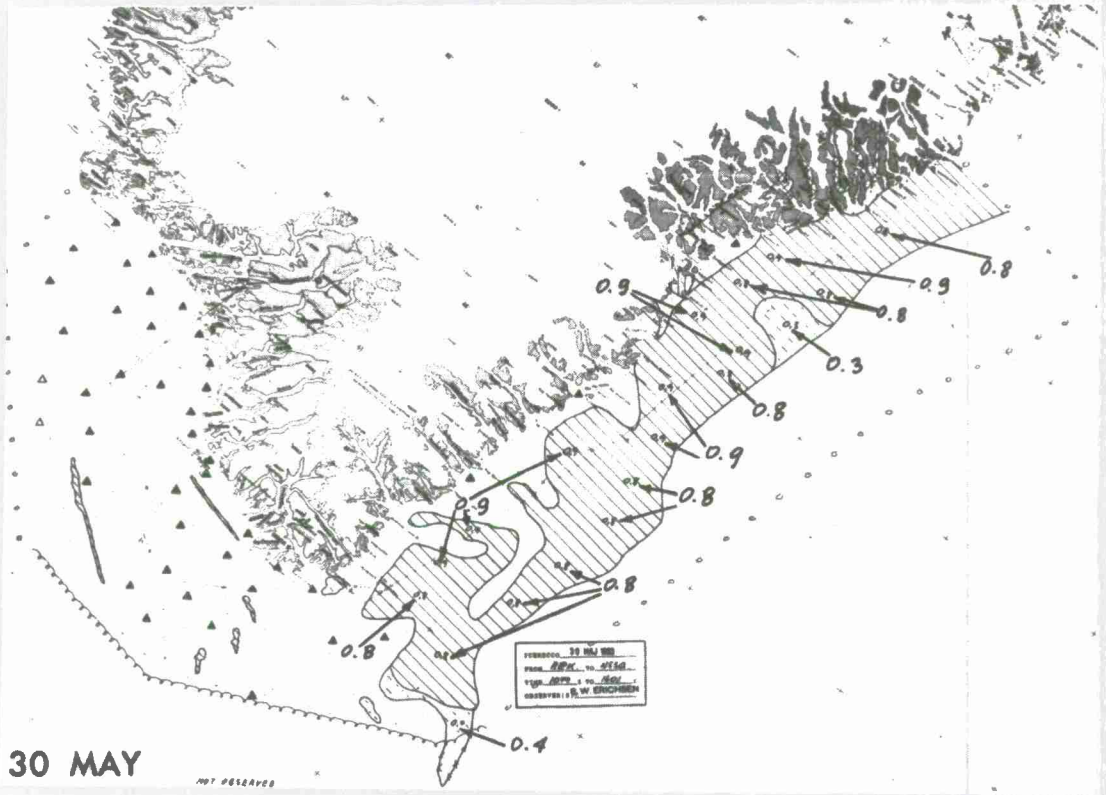
0.5
0.7
0.1
0.7
0.1
0.4
0.2
0.9
0.7
0.5
0.8
0.9
0.7
22 MAY

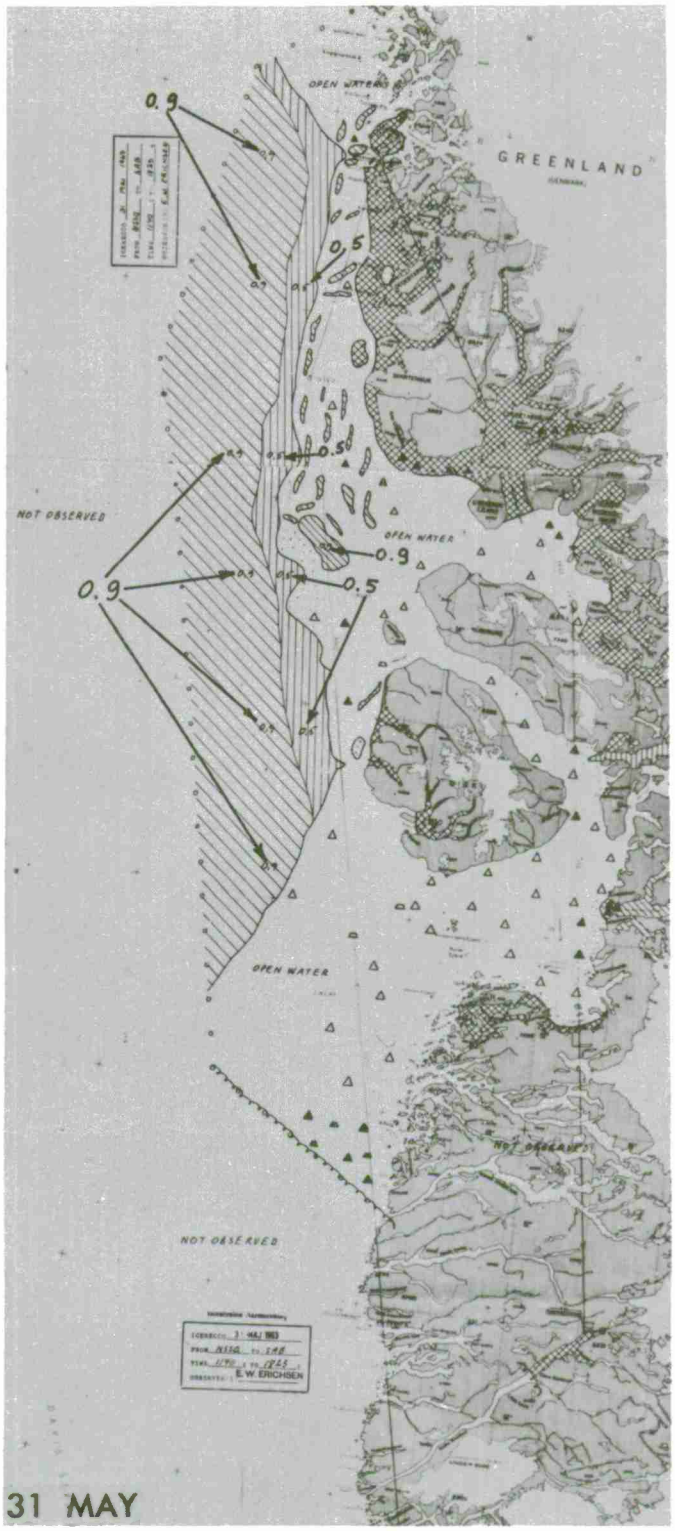

GREENLAND
5/10
8/10
2/10
4/10
6/10
3/10
2/10
8/10
4/10
8/10
5/10
8/10
7/10
2/10
9/10
5/10
OPEN
8/10
7/10
NOT OBSERVED
NOT OBSERVED
26 MAY

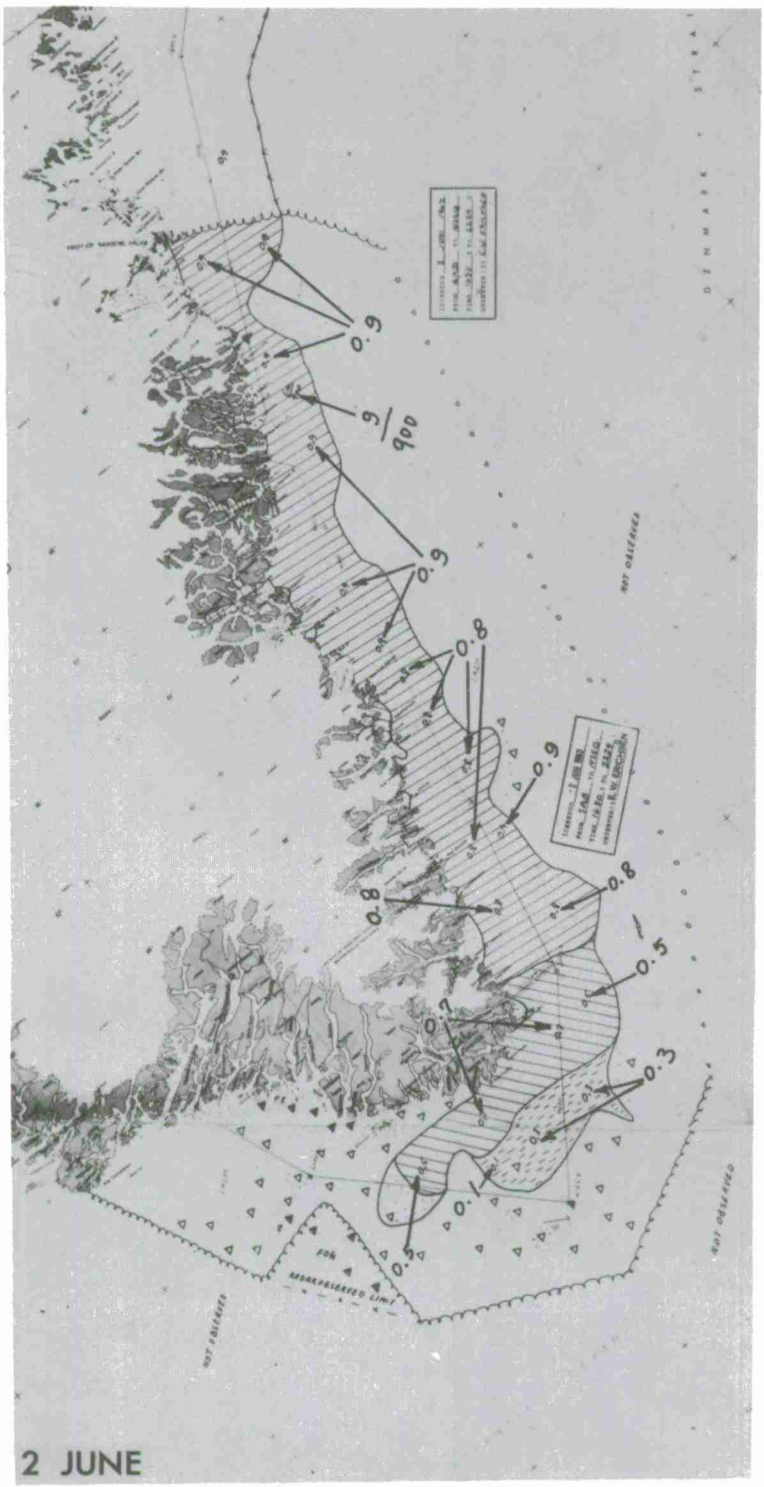

0.4
0.4
0.9
0.9
0.4
0.7
0.7
0.4
0.4
0.8
NOT OBSERVED
OBSERVER: F. W. ERICHSEN

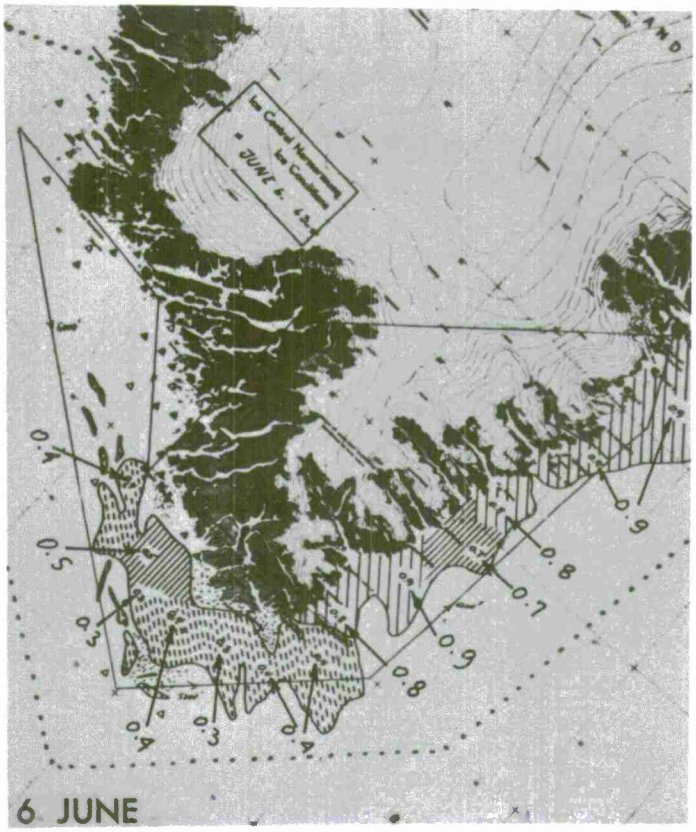
28 MAY


0.8
0.9
0.9
0.8
0.3
0.8
0.9
0.9
0.8
0.8
0.8
0.4
OBSERVER: F. W. ERICHSEN
NOT OBSERVED

30 MAY


GREENLAND
OPEN WATER
0.9
0.5
NOT OBSERVED
OPEN WATER
0.9
0.9
0.5
OPEN WATER
NOT OBSERVED
E.W. ERICHSEN
31 MAY


0.9
9/900
0.9
0.8
0.9
0.8
0.8
0.5
0.7
0.3
0.1
0.5
NOT OBSERVED
NOT OBSERVED
NOT OBSERVED
FOG
REDUCED VISIBILITY LIMIT
DENMARK
2 JUNE


LAND
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0.5
0.3
0.4
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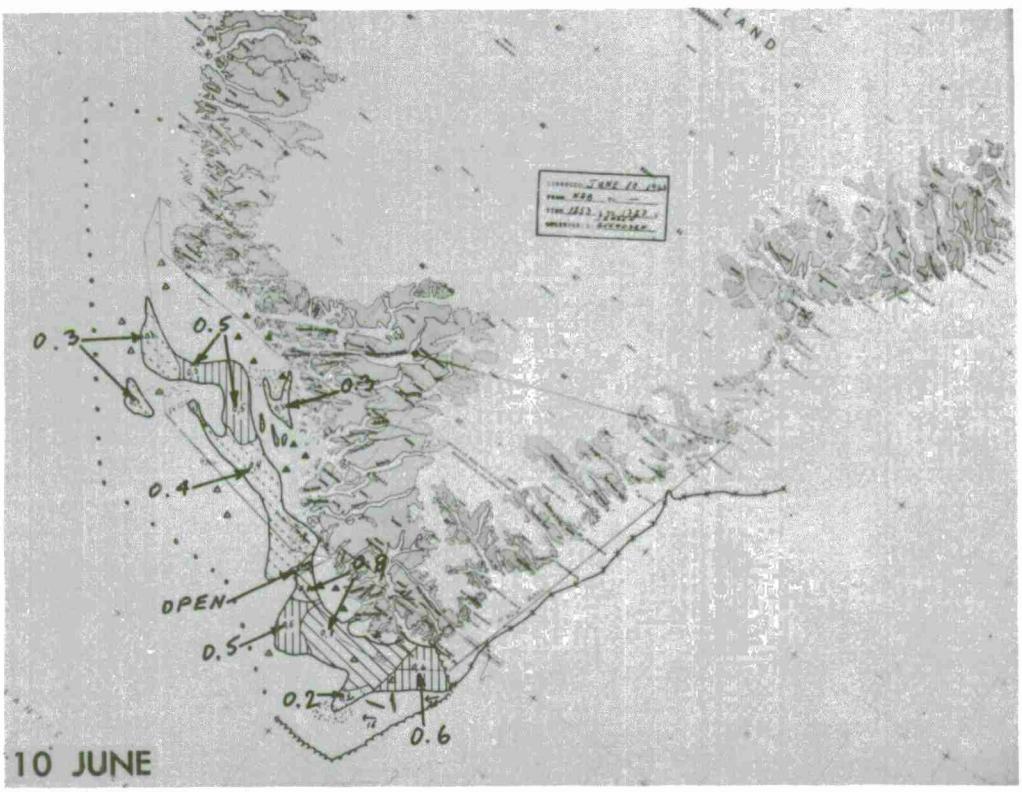
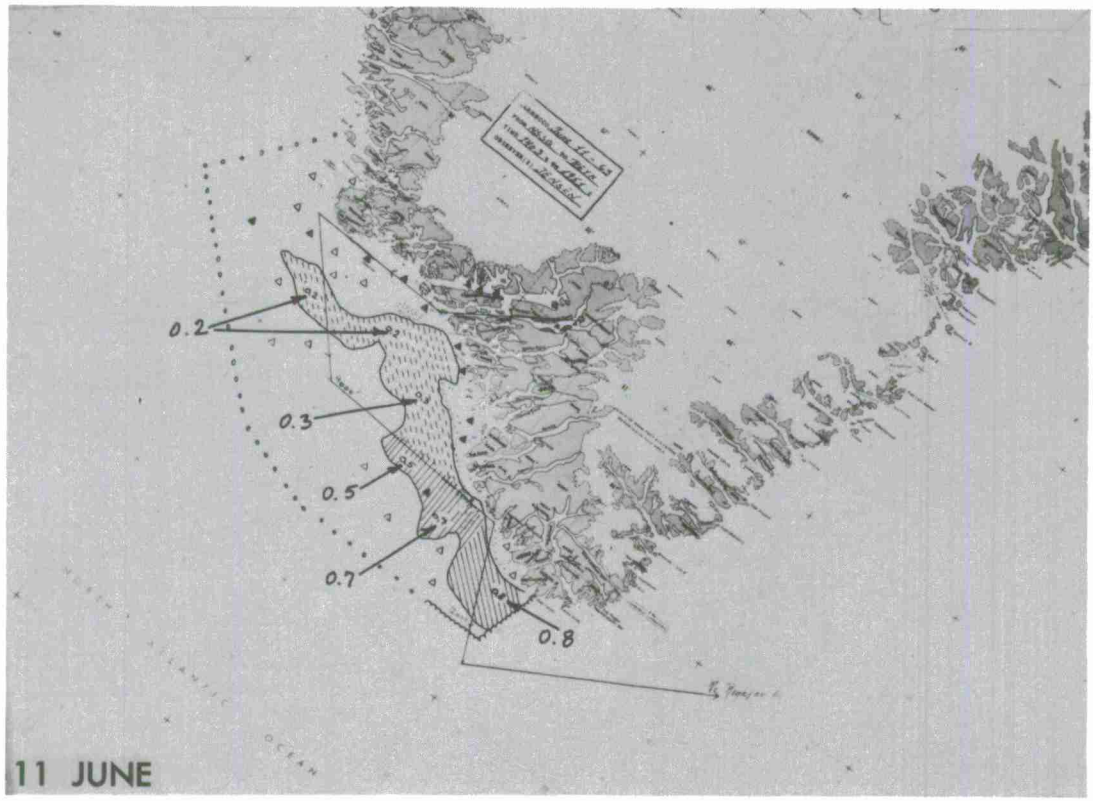
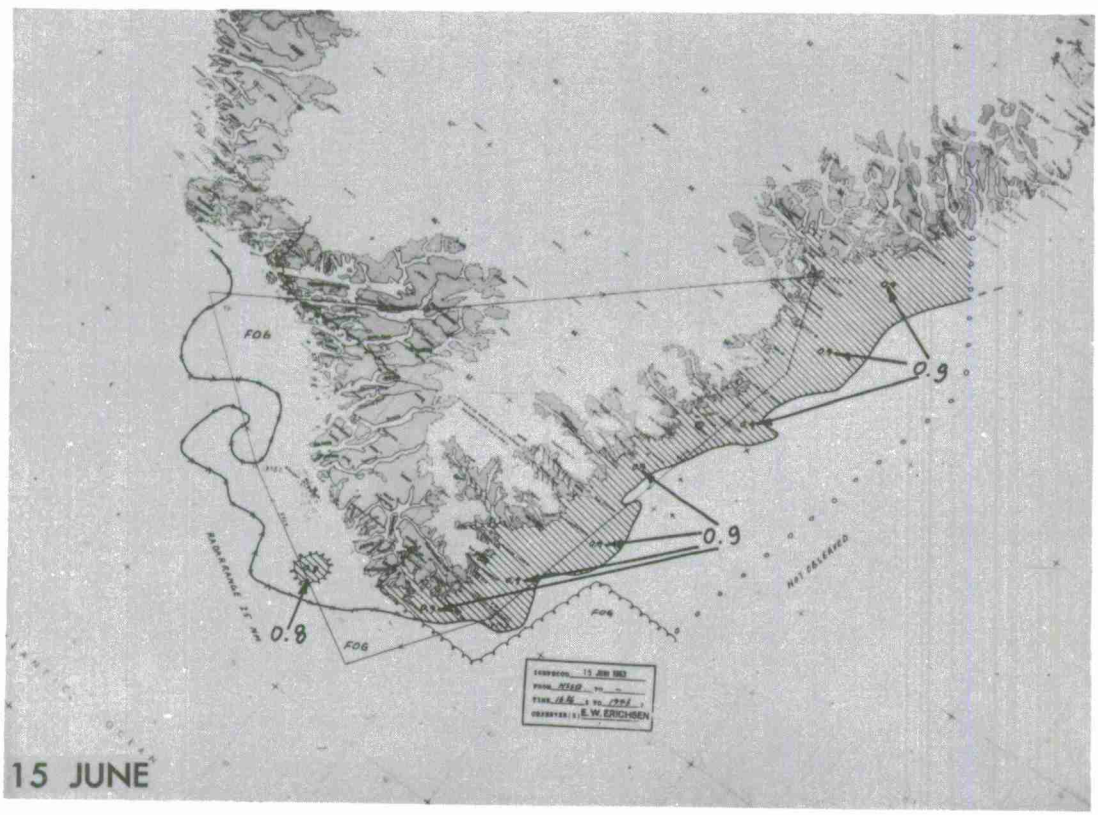
0.4
0.8
0.9
0.7
0.9
0.8
6 JUNE

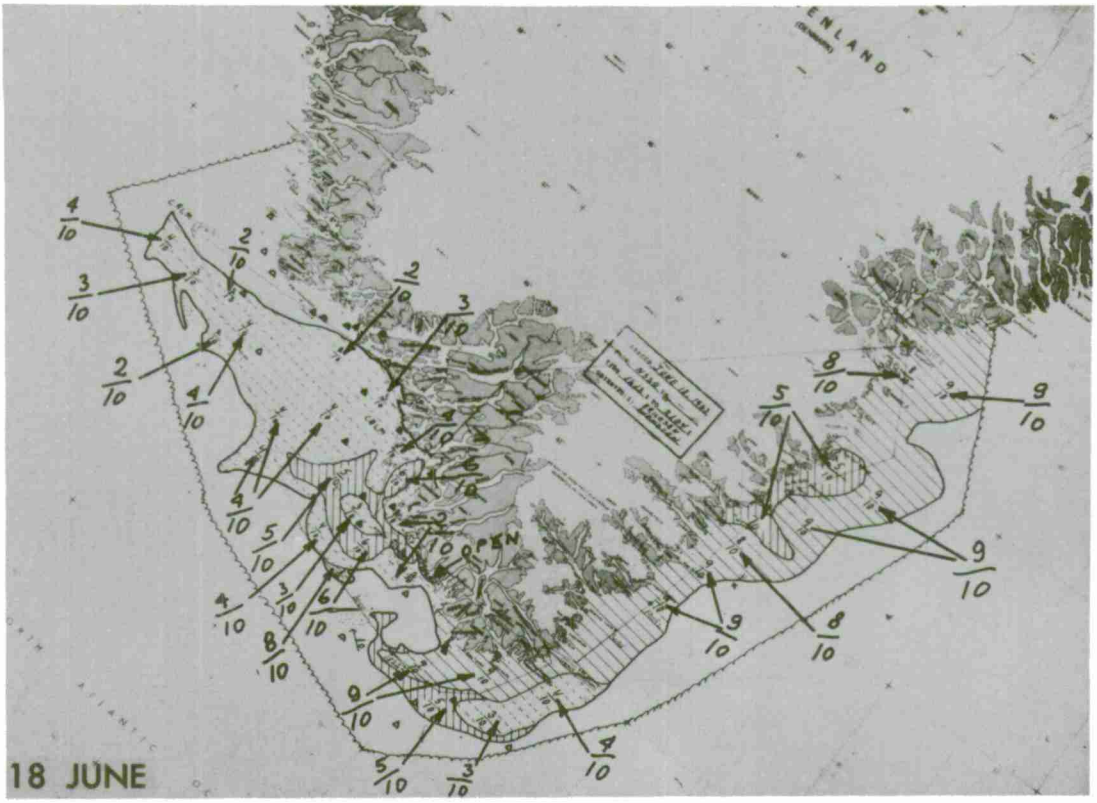

LAND
0.3
0.5
0.3
0.4
OPEN
0.9
0.5
0.2
0.6
10 JUNE

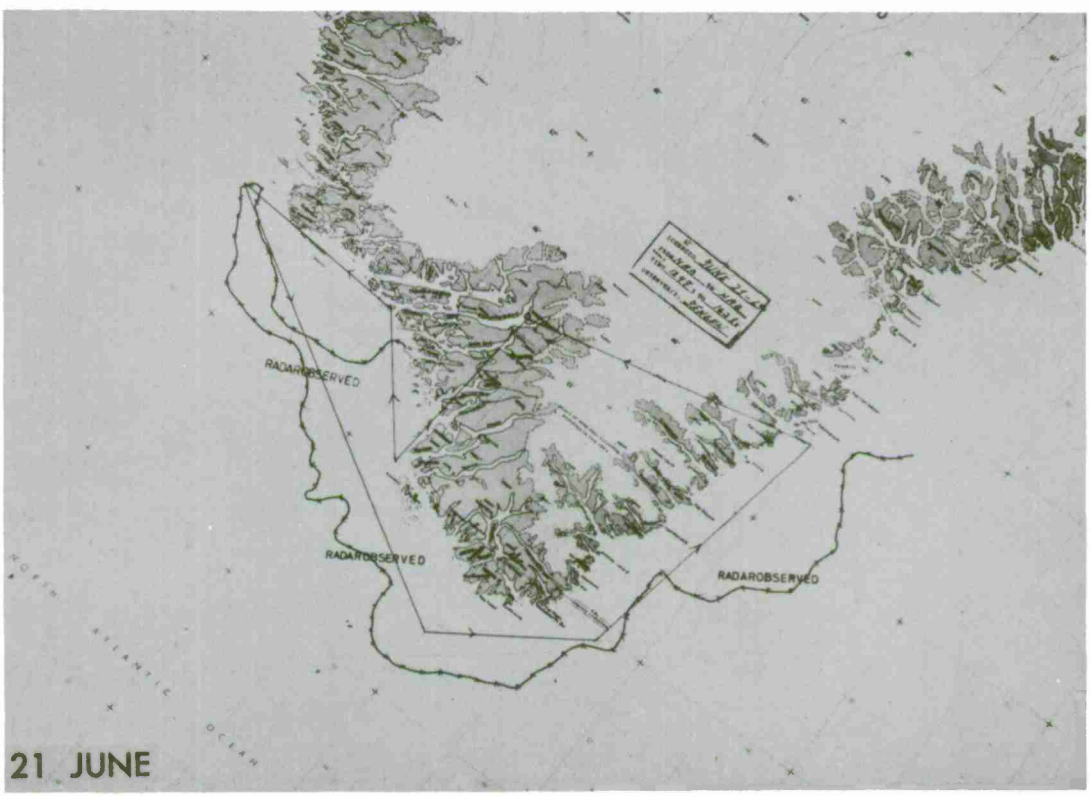


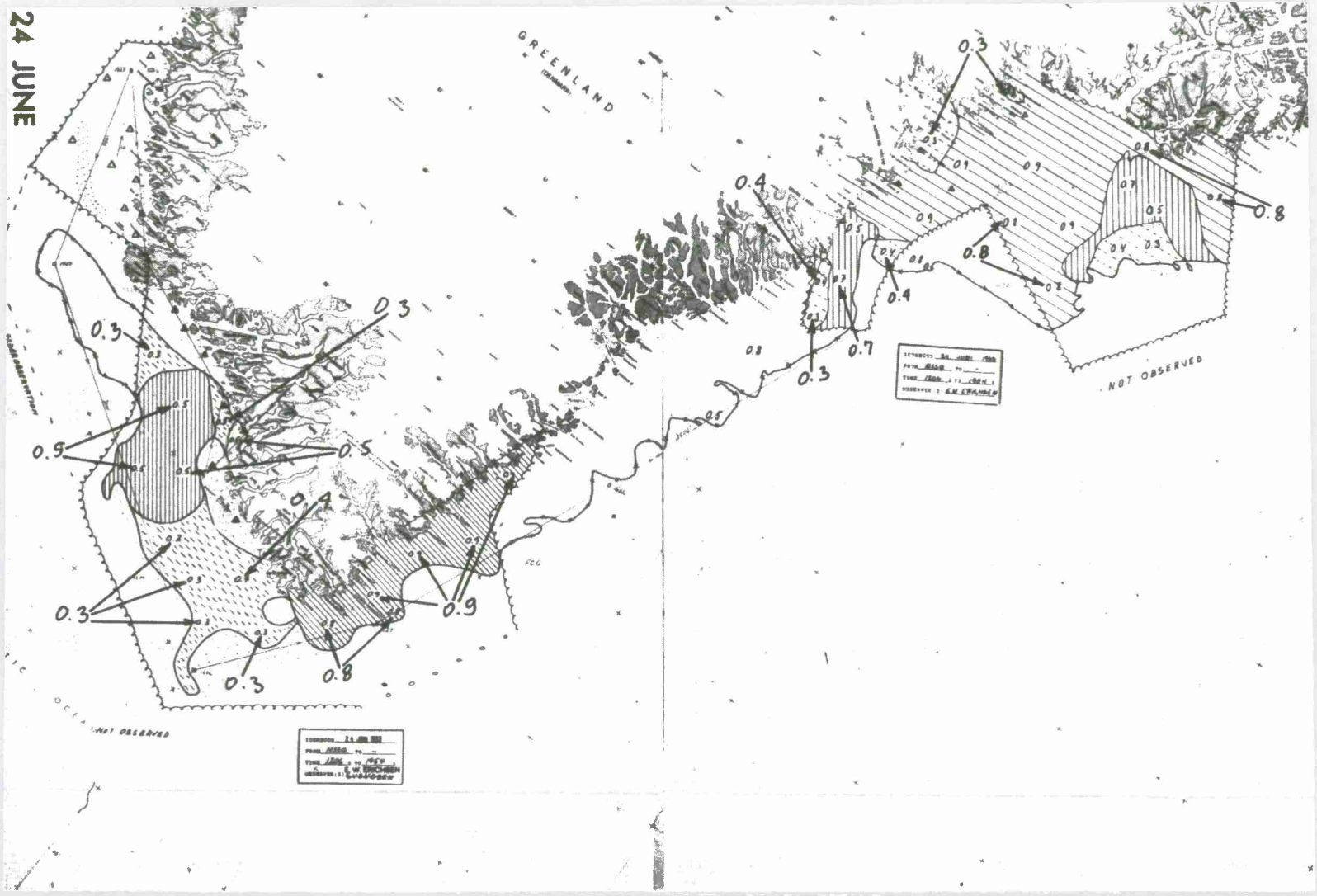
11 JUNE



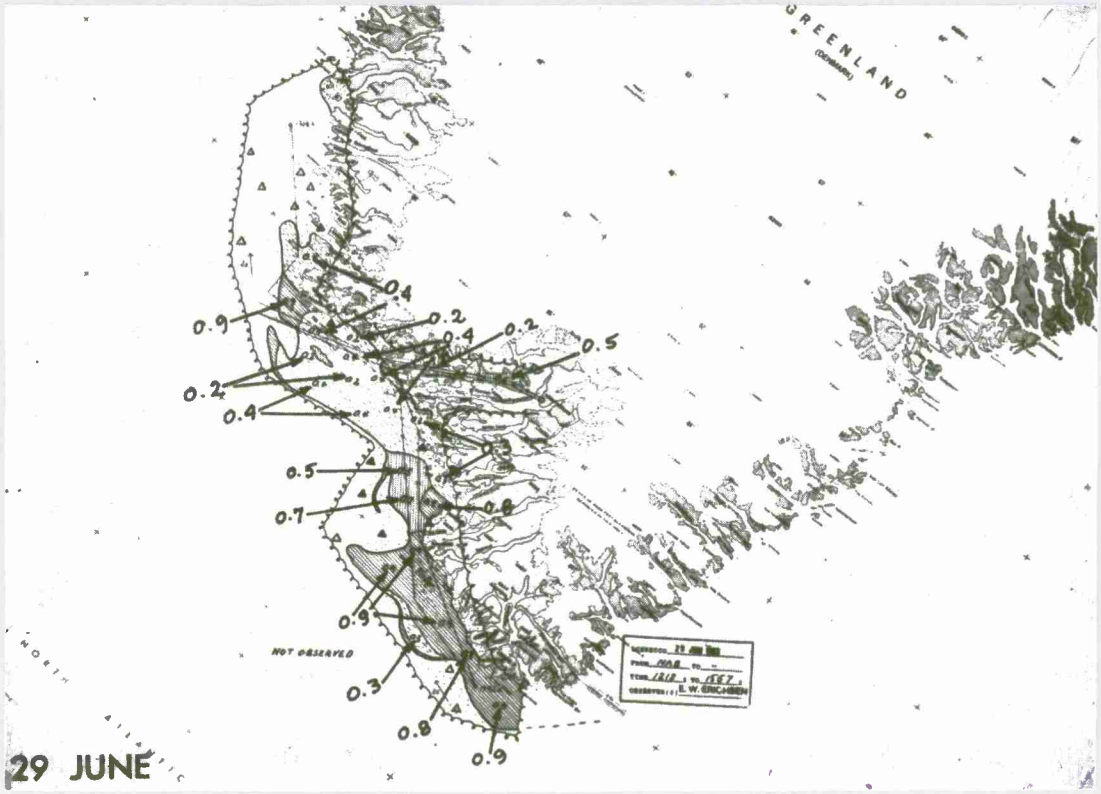
15 JUNE


18 JUNE

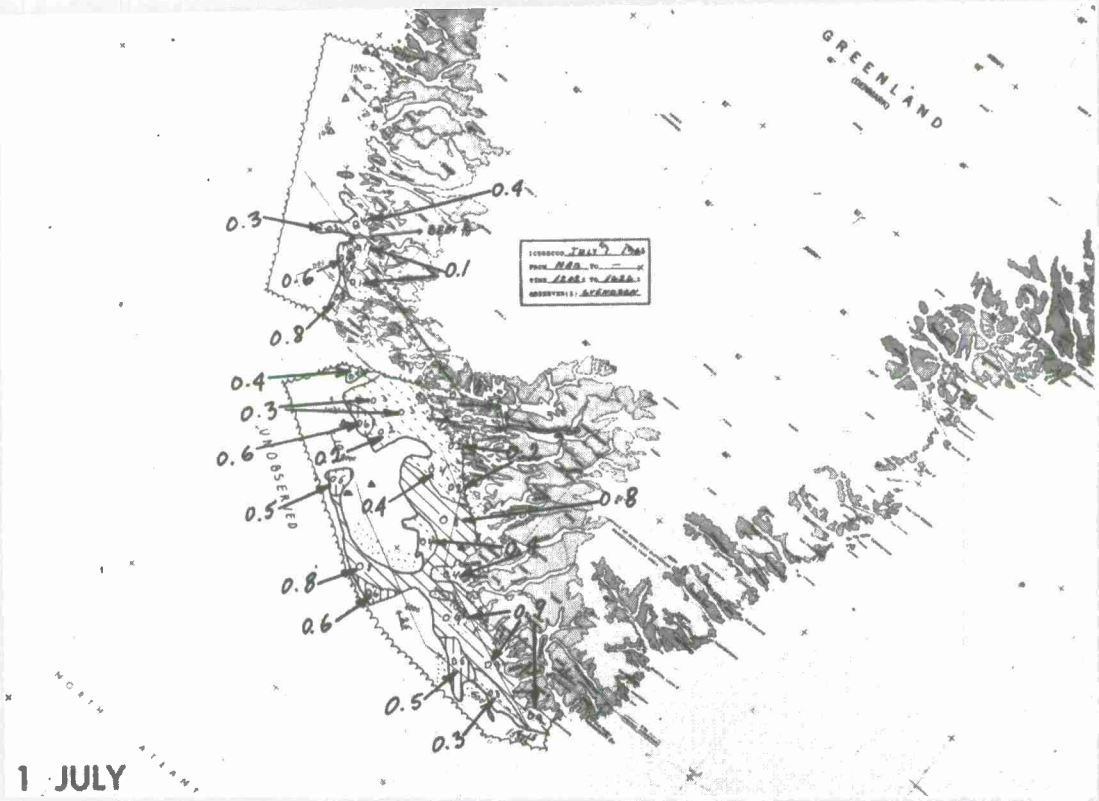

RADAROBSERVED
RADAROBSERVED
RADAROBSERVED
21 JUNE


24 JUNE
GREENLAND
NOT OBSERVED
NOT OBSERVED

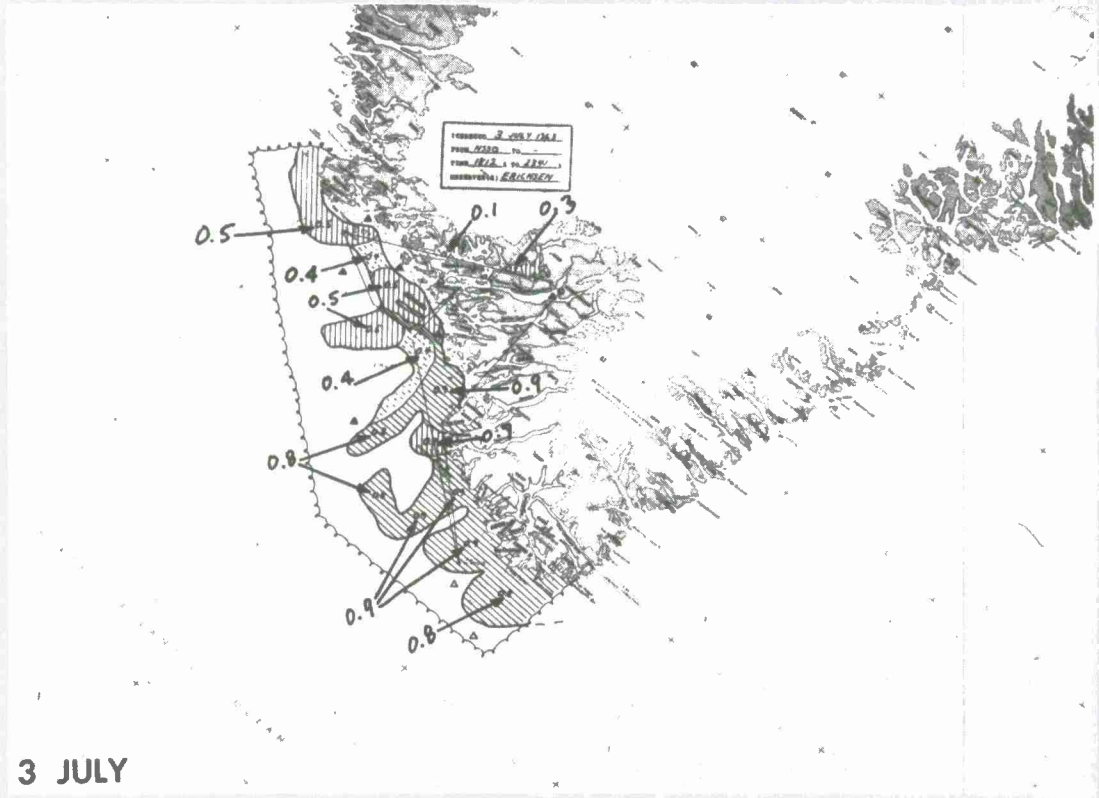
26 JUNE



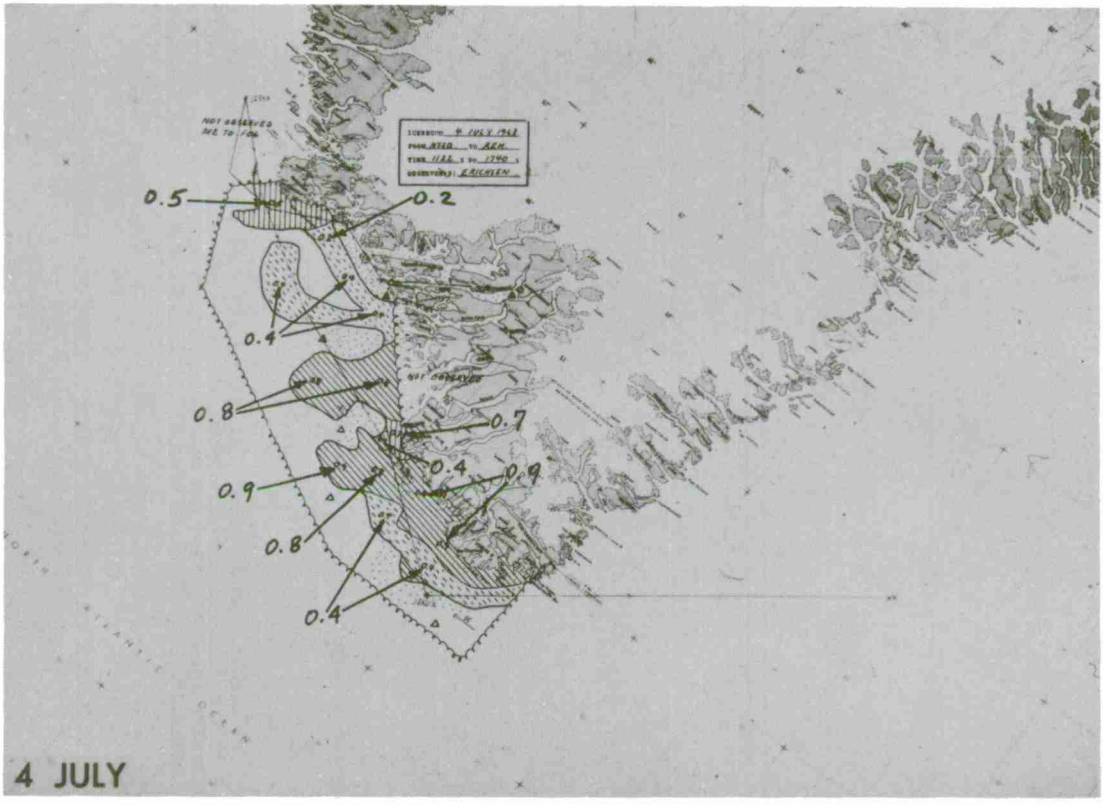
29 JUNE

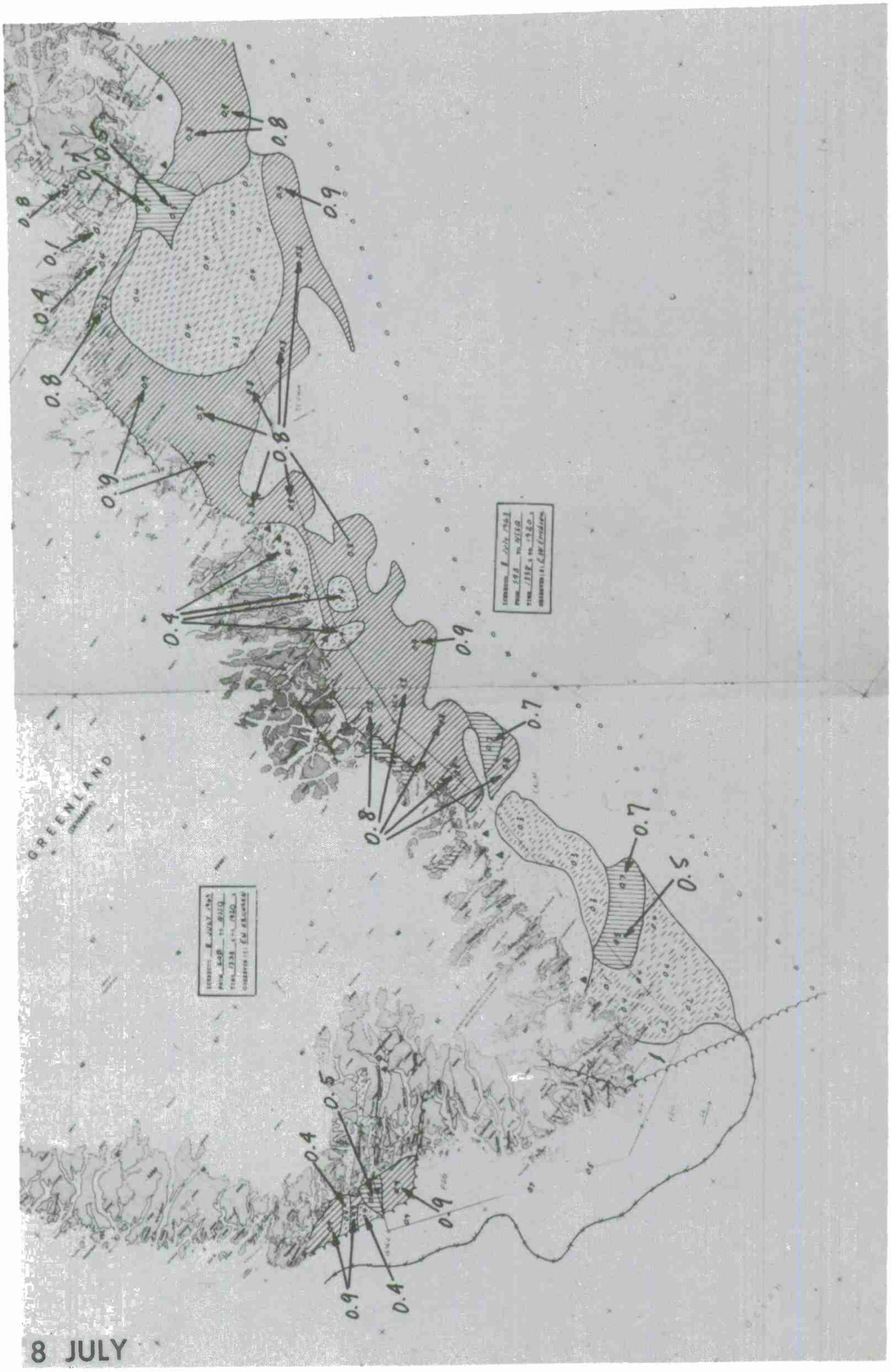

GREENLAND
0.4
0.3
0.1
0.6
0.8
0.4
0.3
0.6
0.2
0.5
0.4
0.8
0.8
0.6
0.5
0.3
UNOBSERVED

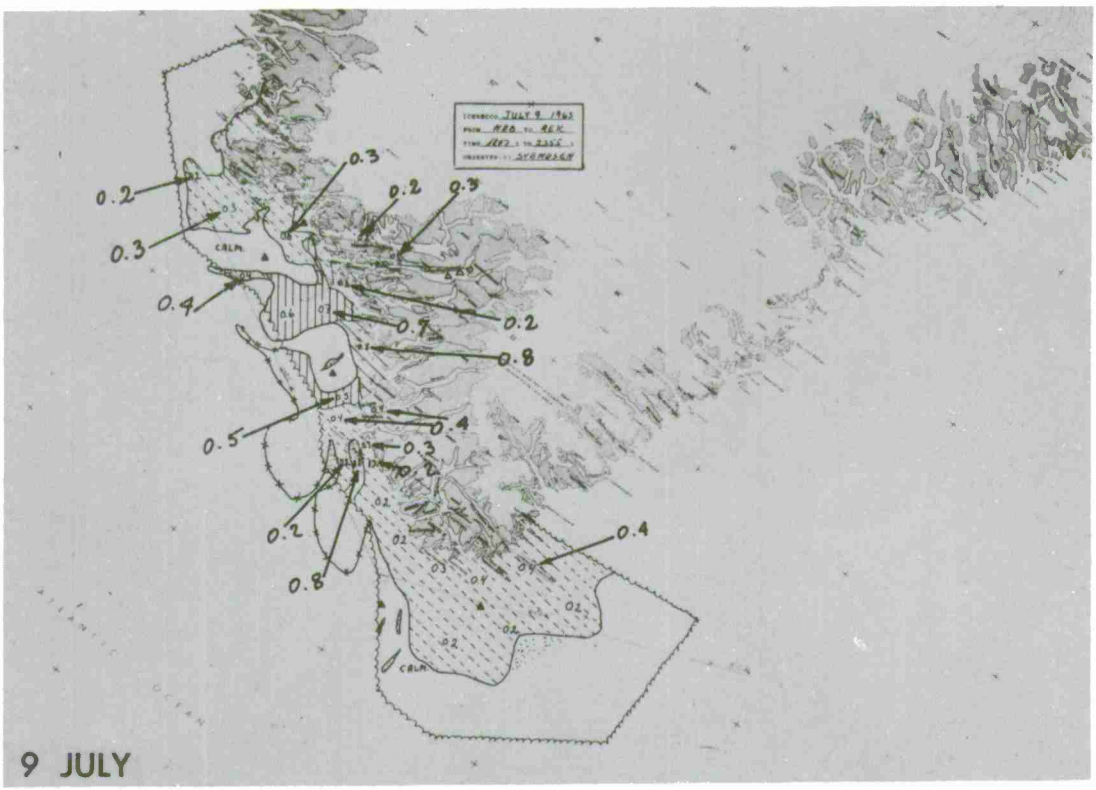
1 JULY

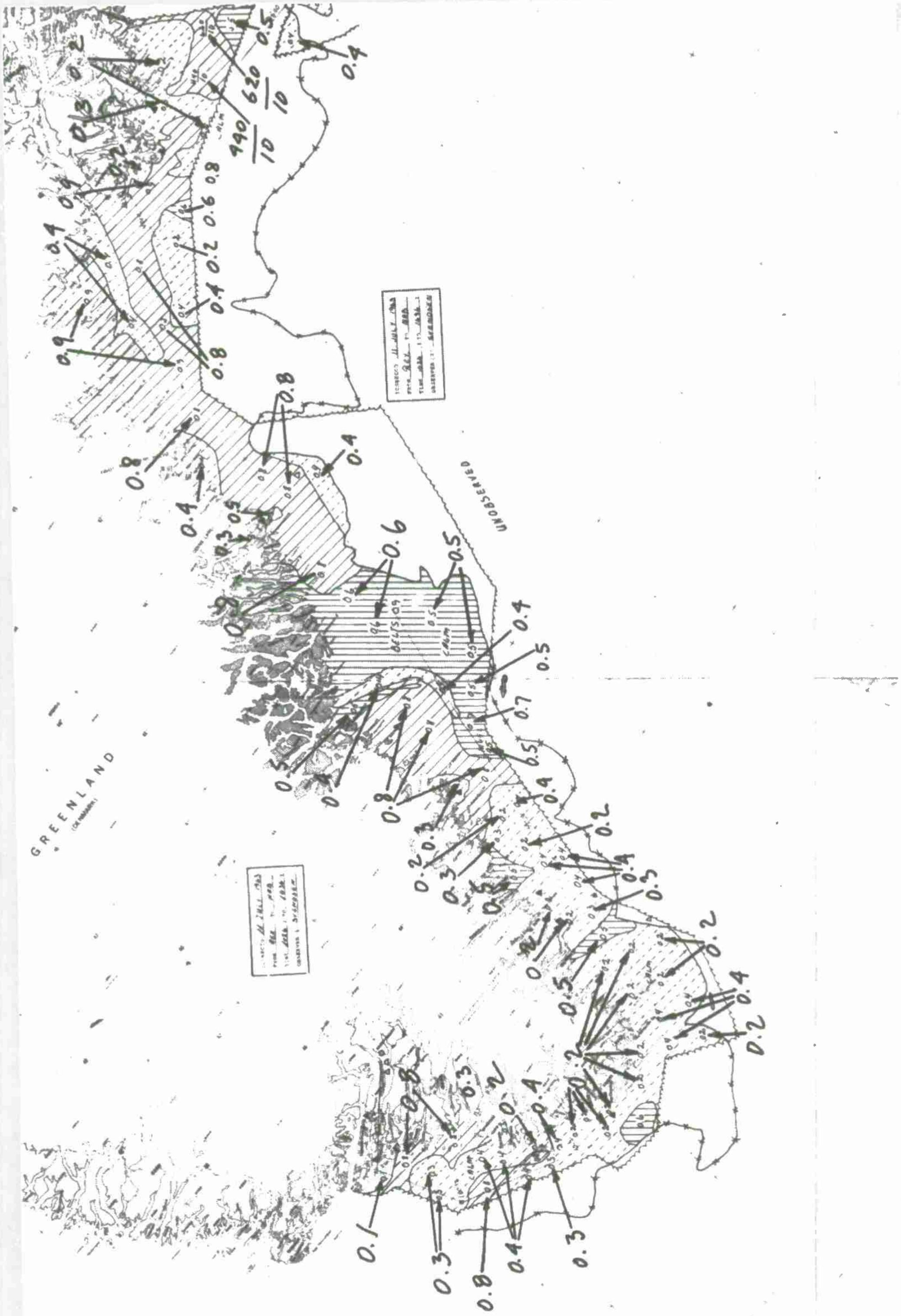

0.1
0.3
0.5
0.4
0.5
0.4
0.9
0.8
0.9
0.8

3 JULY

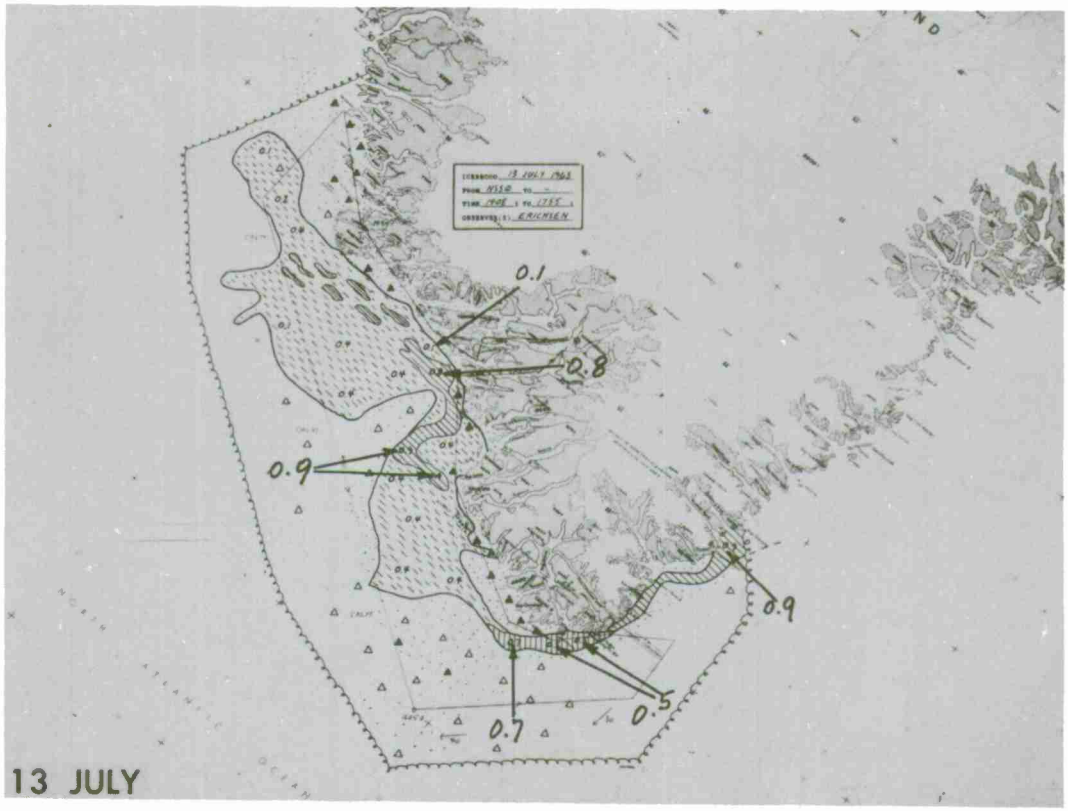

0.5
0.2
0.4
0.8
0.7
0.4
0.9
0.9
0.8
0.4
4 JULY

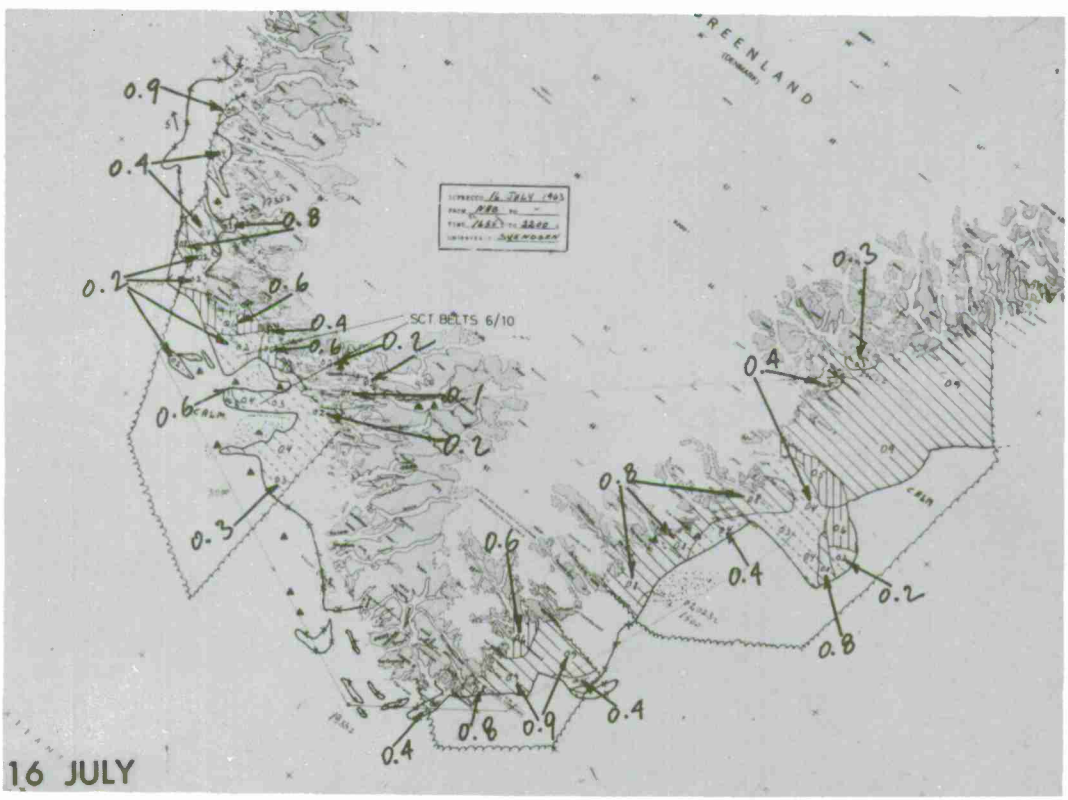

8 JULY

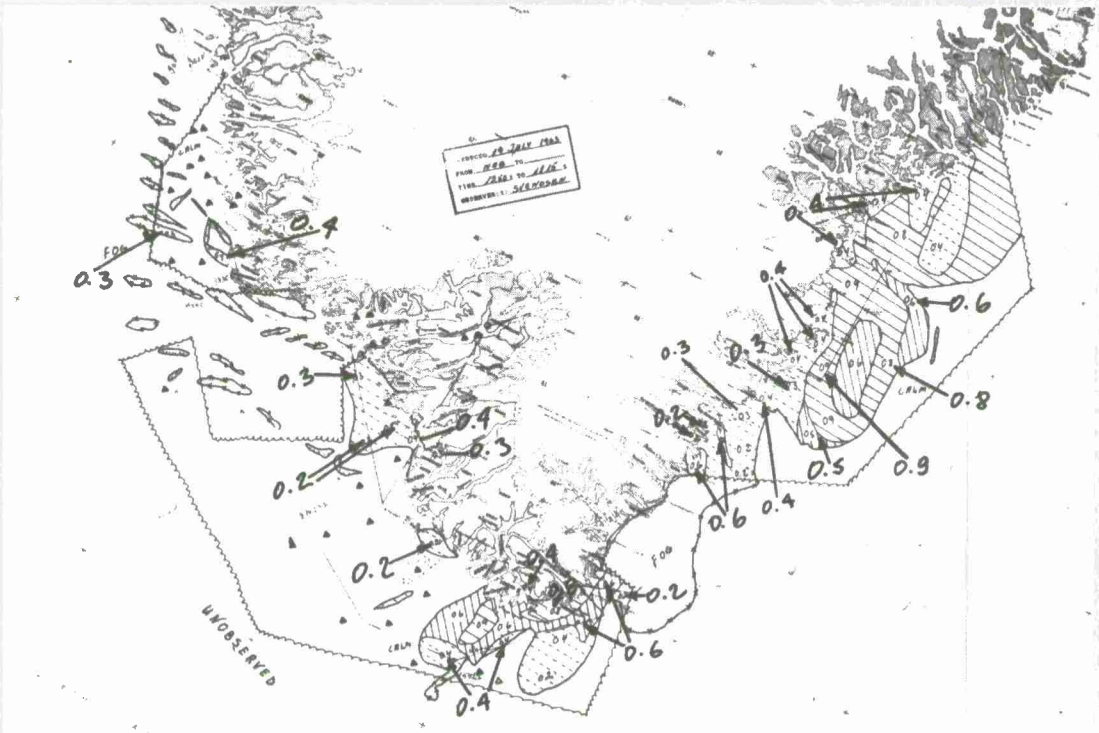

0.2
0.3
0.4
0.3
0.2
0.3
0.2
0.8
0.5
0.4
0.3
0.2
0.8
0.4
CALM
CALM
9 JULY



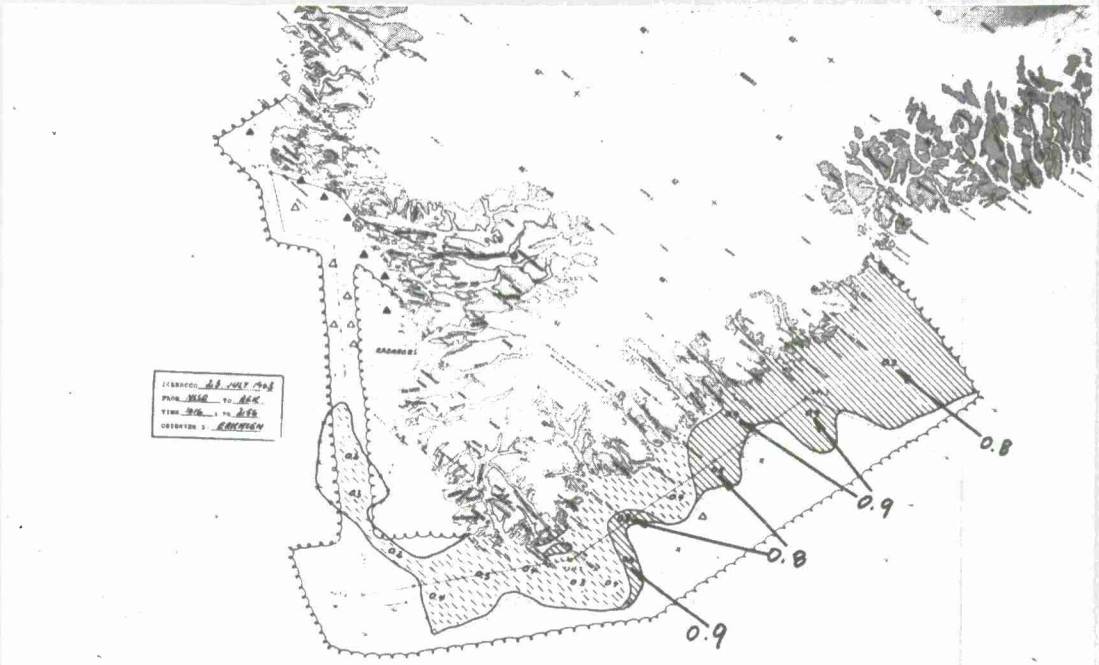
11 JULY


0.1
0.8
0.9
0.9
0.7
0.5
13 JULY


GREENLAND
0.9
0.4
0.8
0.2
0.6
0.4
0.6
0.2
SCT BELTS 6/10
0.1
0.6
0.2
0.3
0.3
0.4
0.8
0.2
0.8
0.6
0.4
0.4
0.8
0.9
16 JULY

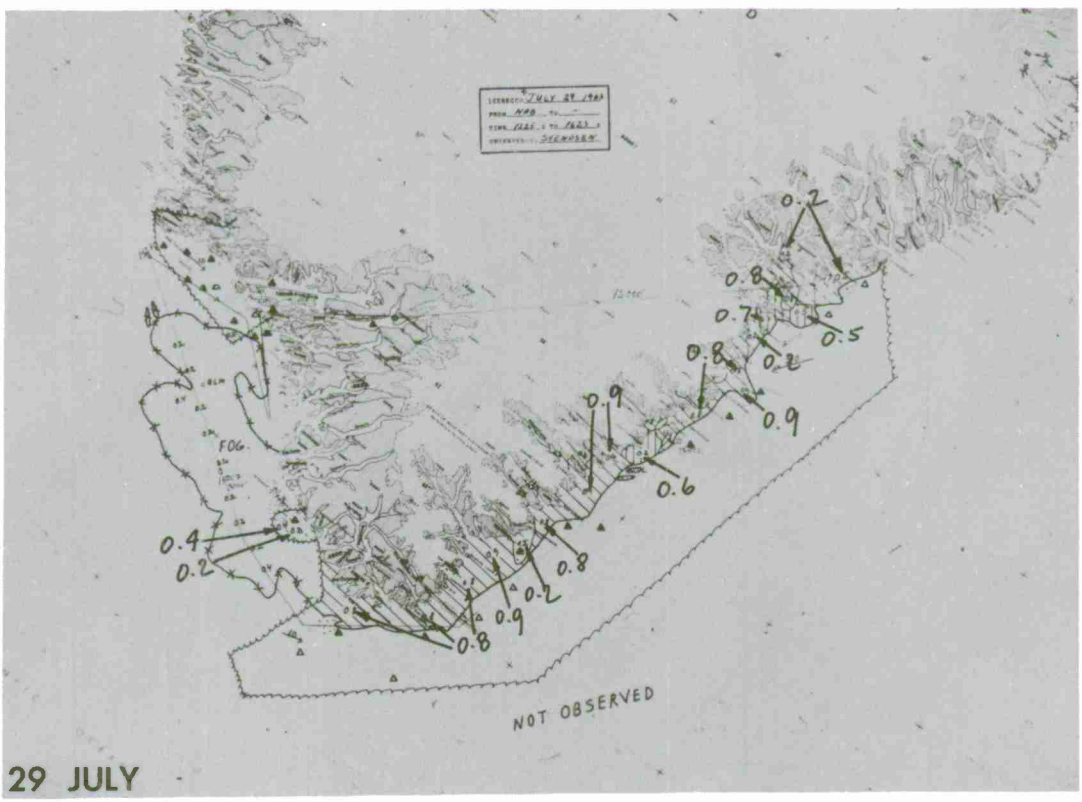


19 JULY

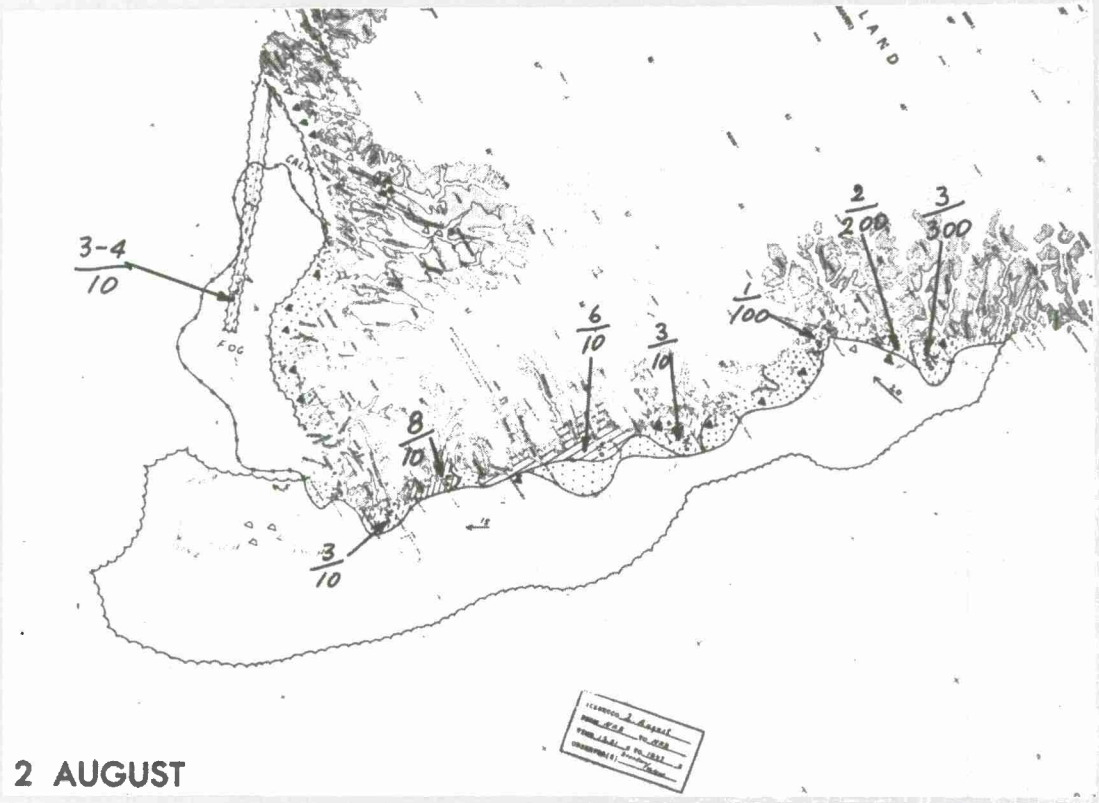


23 JULY

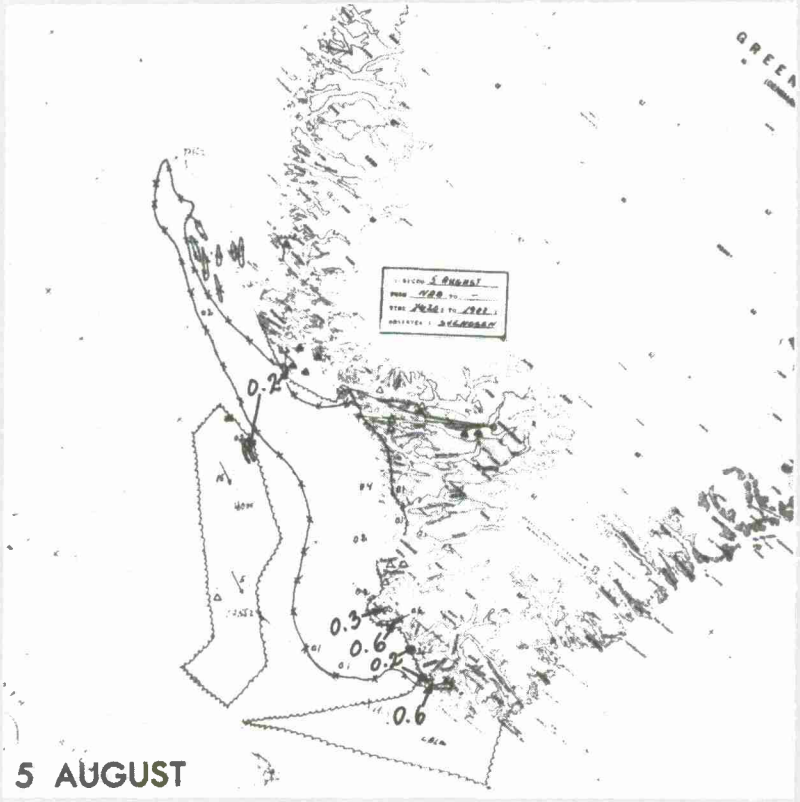
26 JULY



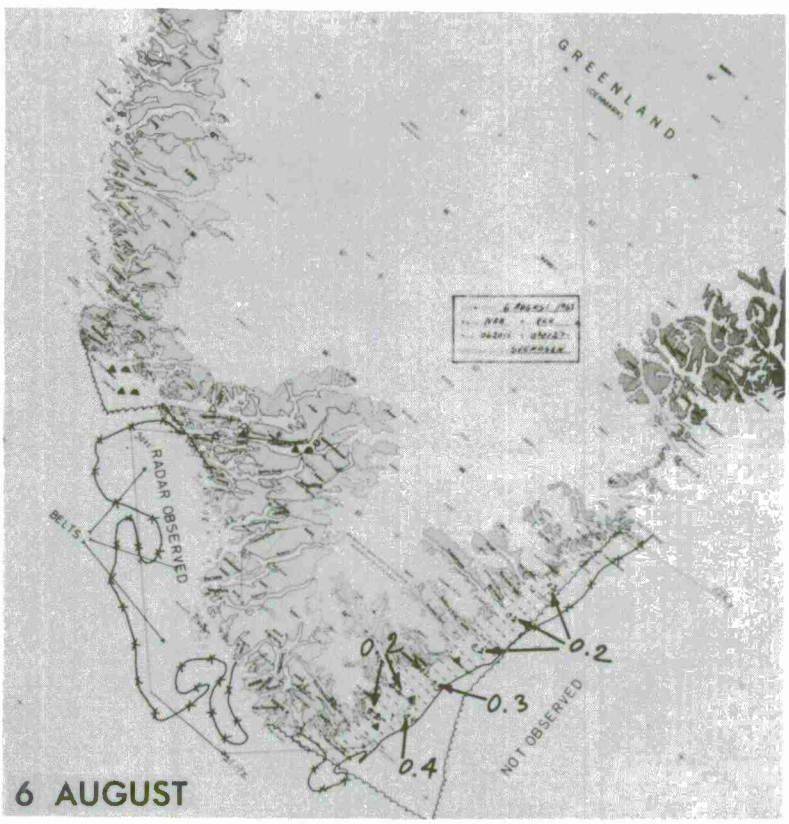
29 JULY

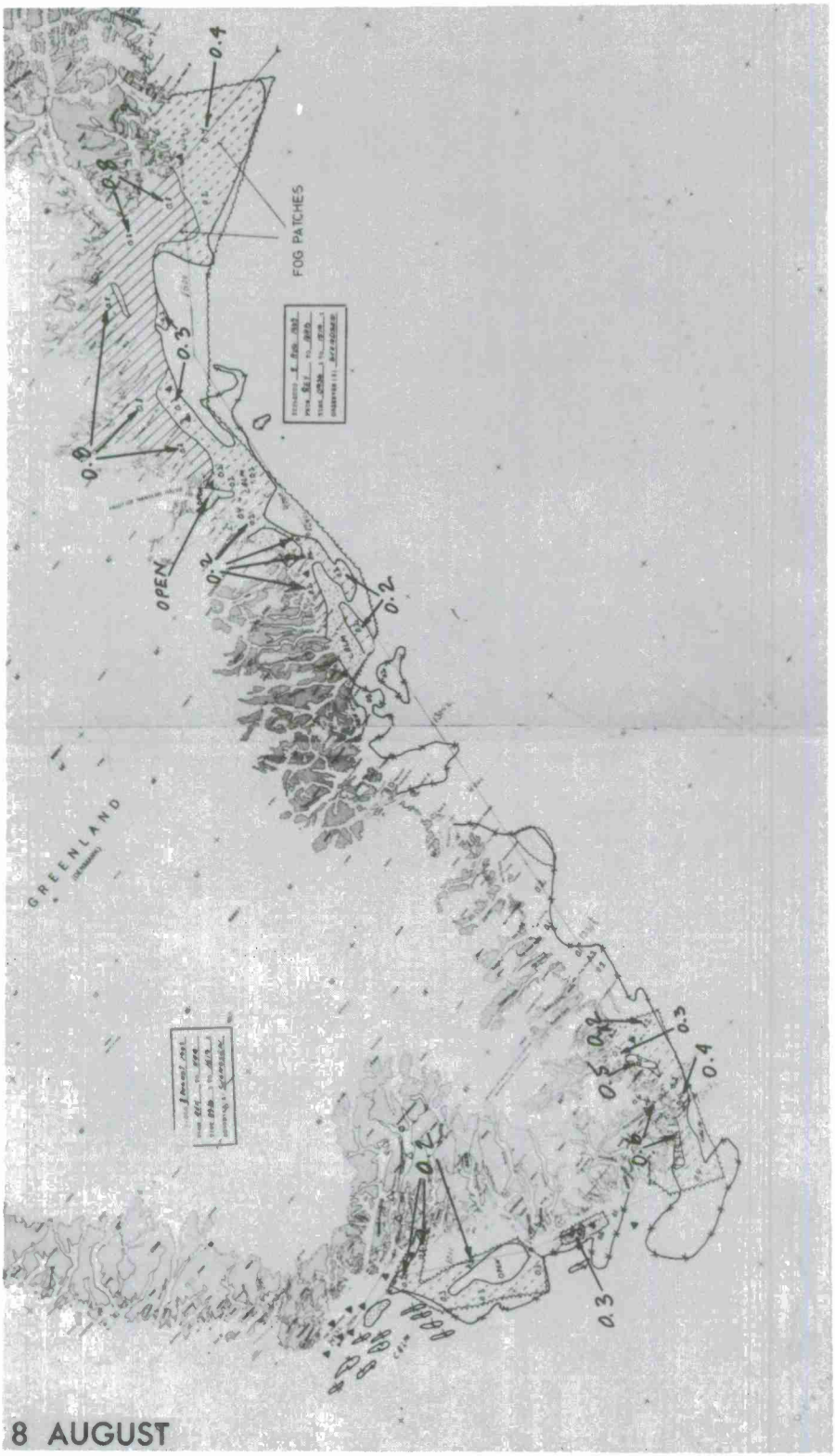


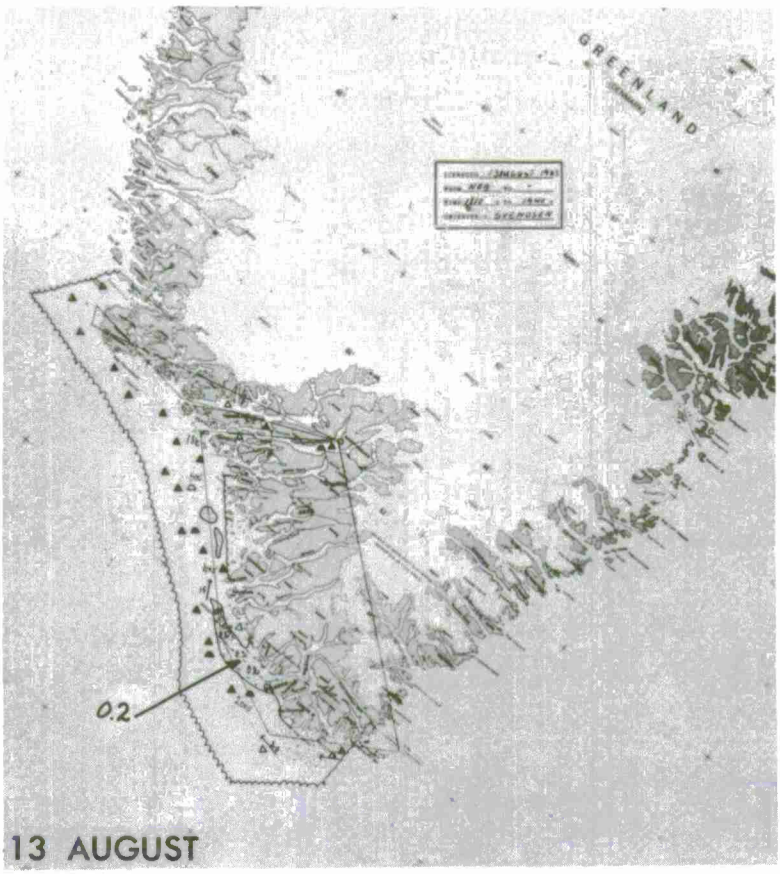
2 AUGUST

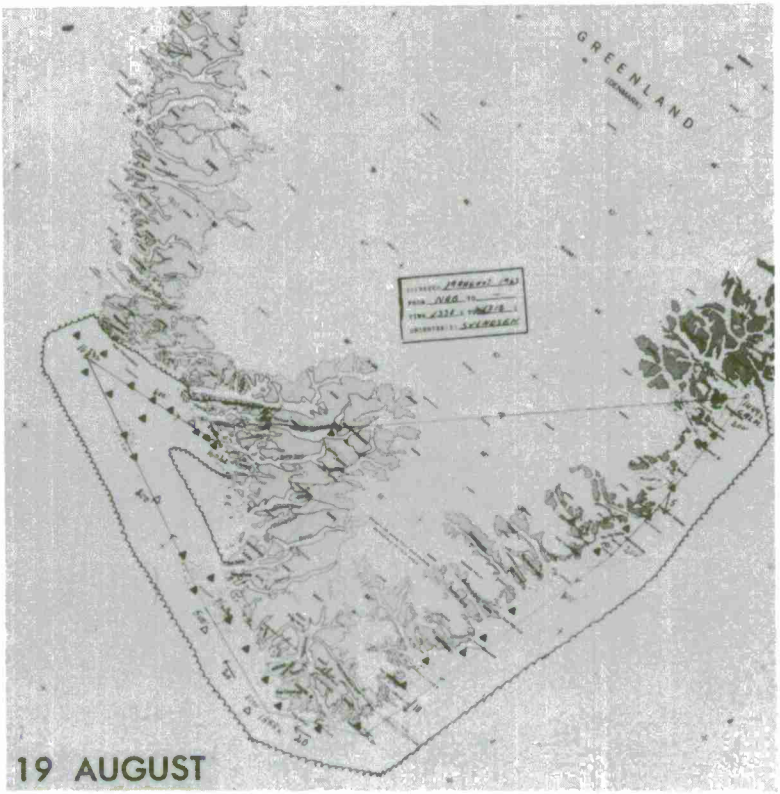


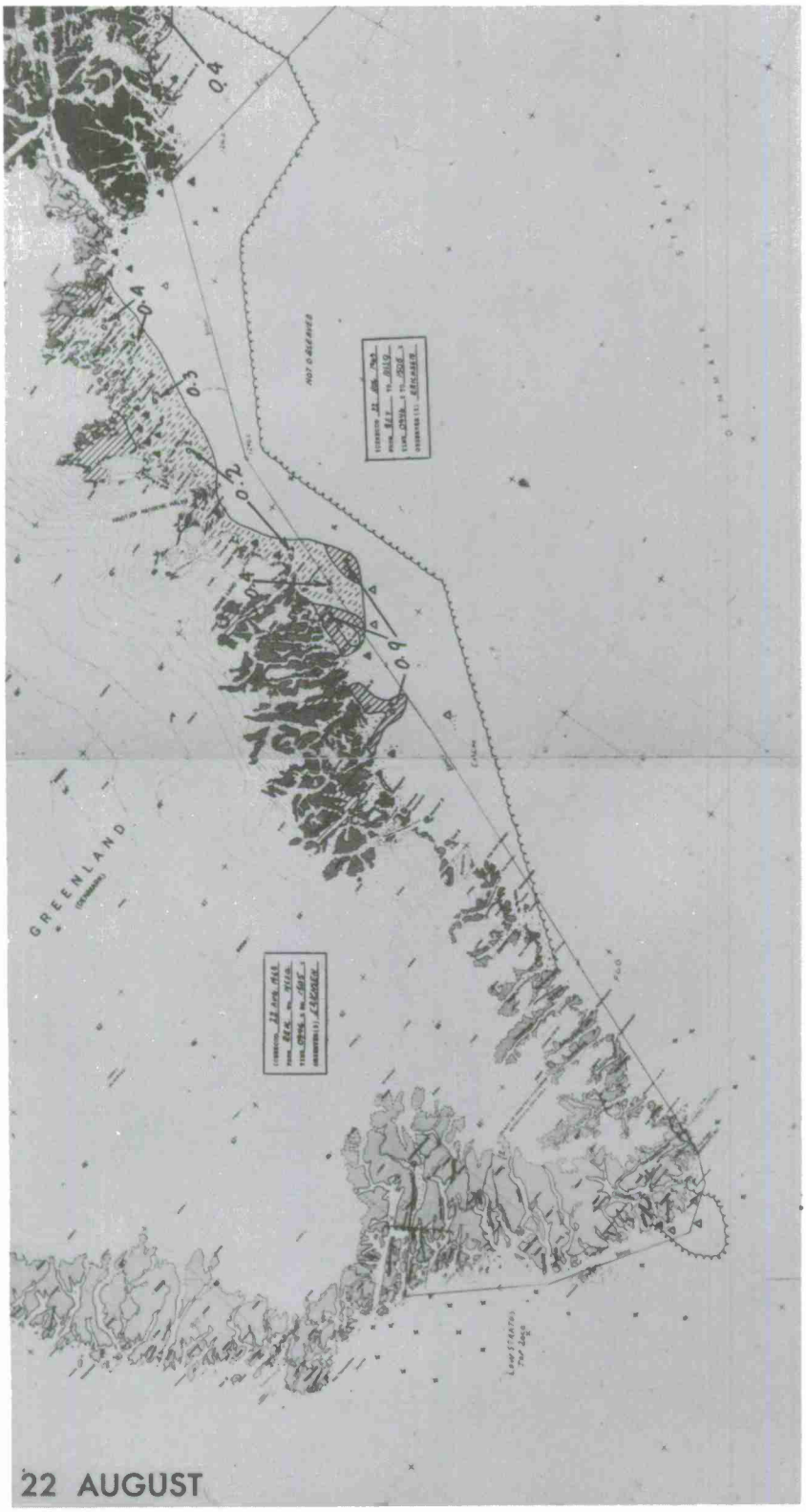
5 AUGUST


GREENLAND
RADAR OBSERVED
BELTS
0.2
0.2
0.3
0.4
NOT OBSERVED
6 AUGUST

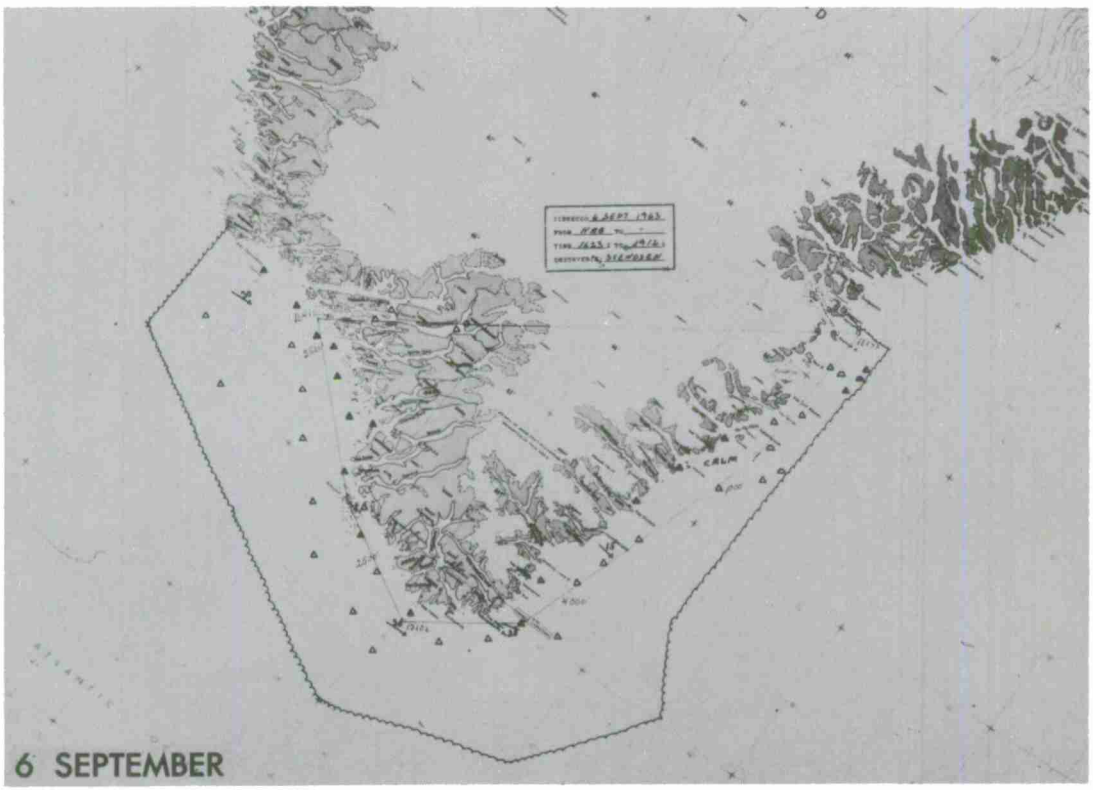

FOG PATCHES
OPEN
GREENLAND
0.4
0.3
0.2
0.1
0.5
0.7
8 AUGUST


GREENLAND
0.2
13 AUGUST

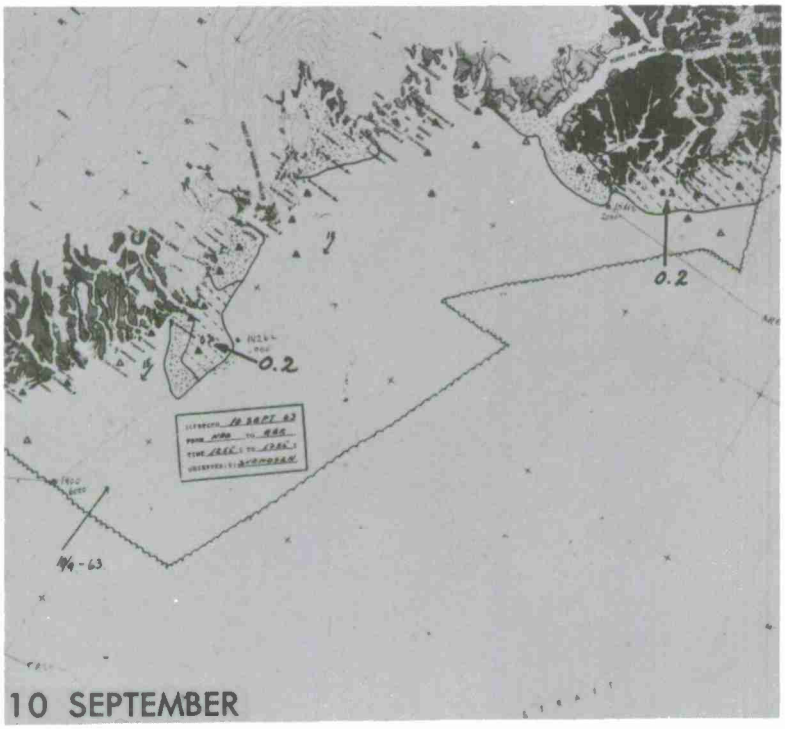

GREENLAND
19 AUGUST


GREENLAND
22 AUGUST

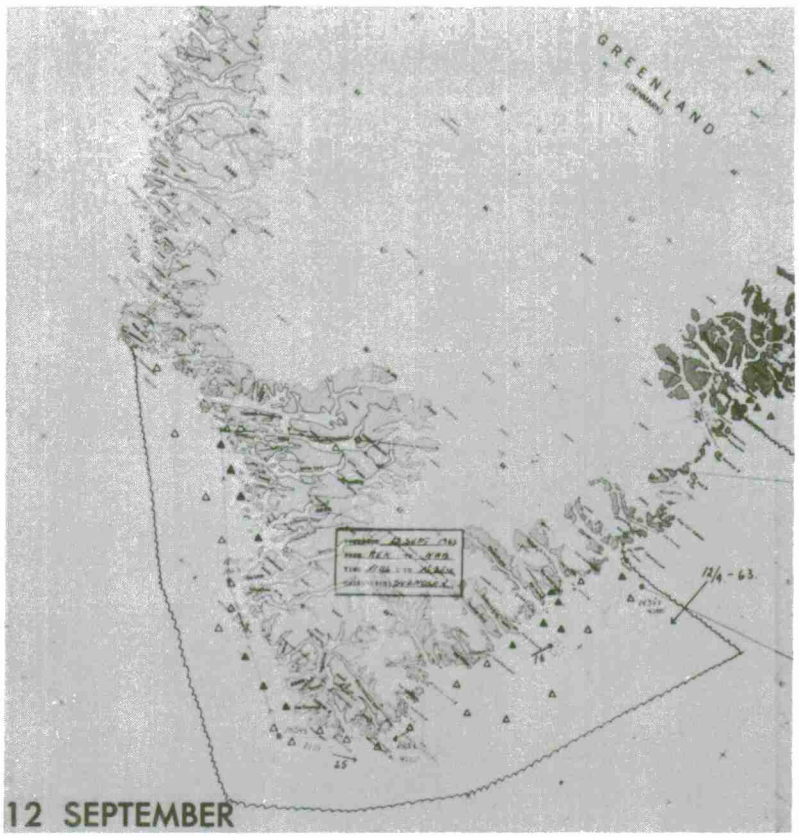
29 AUGUST



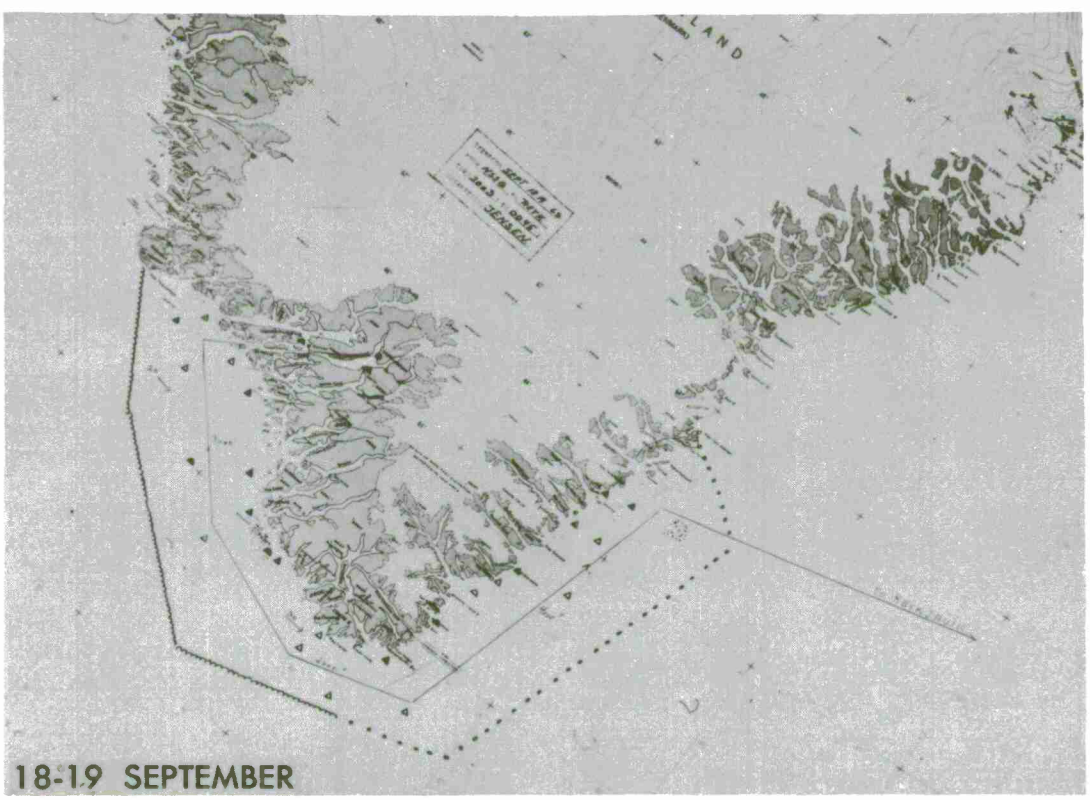
6 SEPTEMBER



10 SEPTEMBER



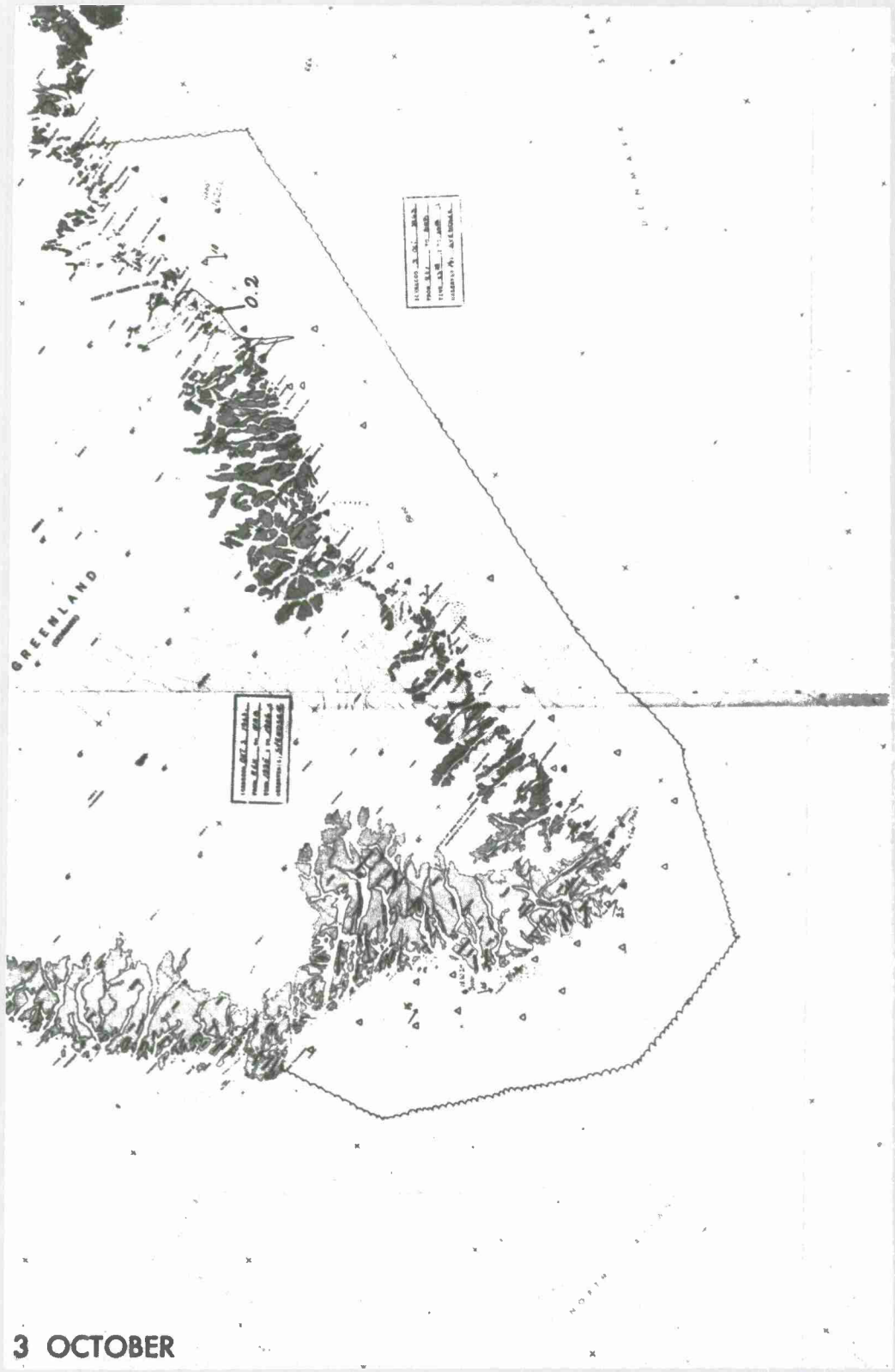
12 SEPTEMBER



18-19 SEPTEMBER

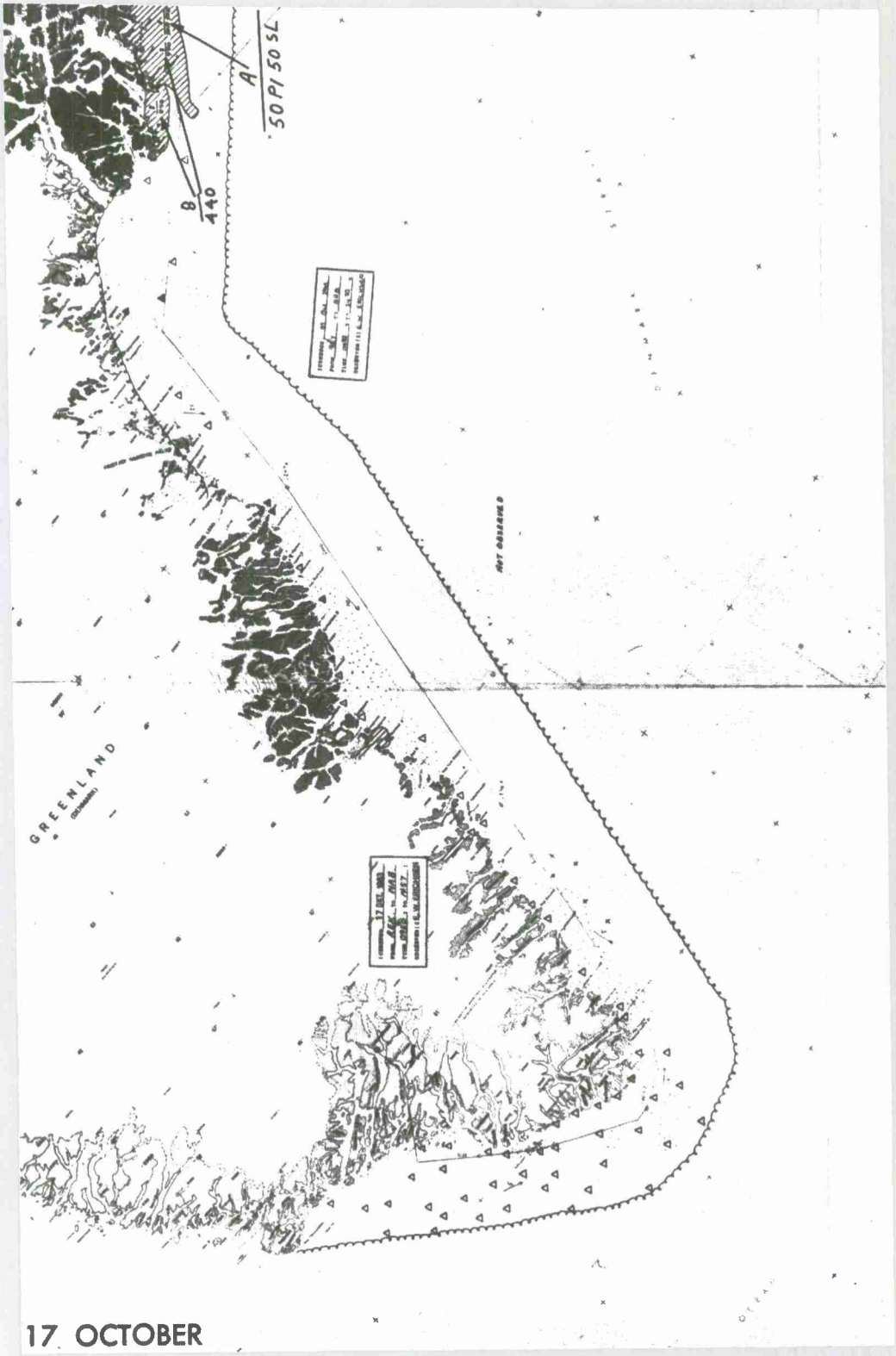

19 SEPTEMBER

25 SEPTEMBER

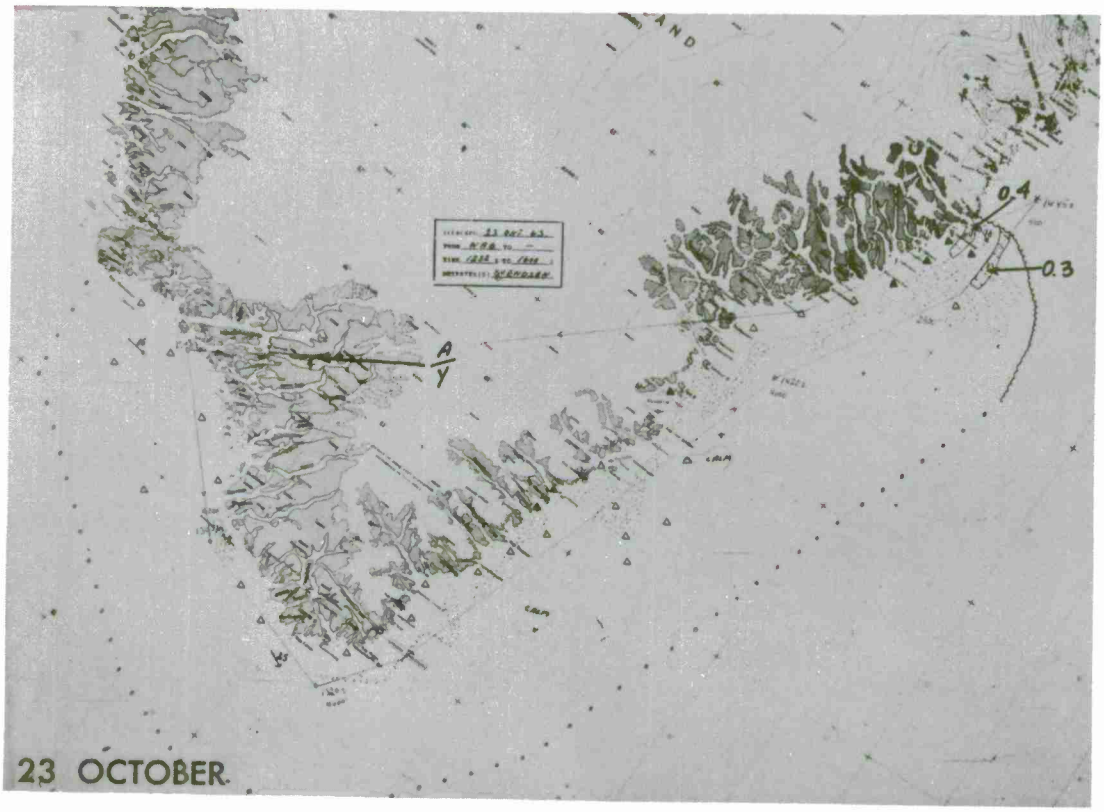


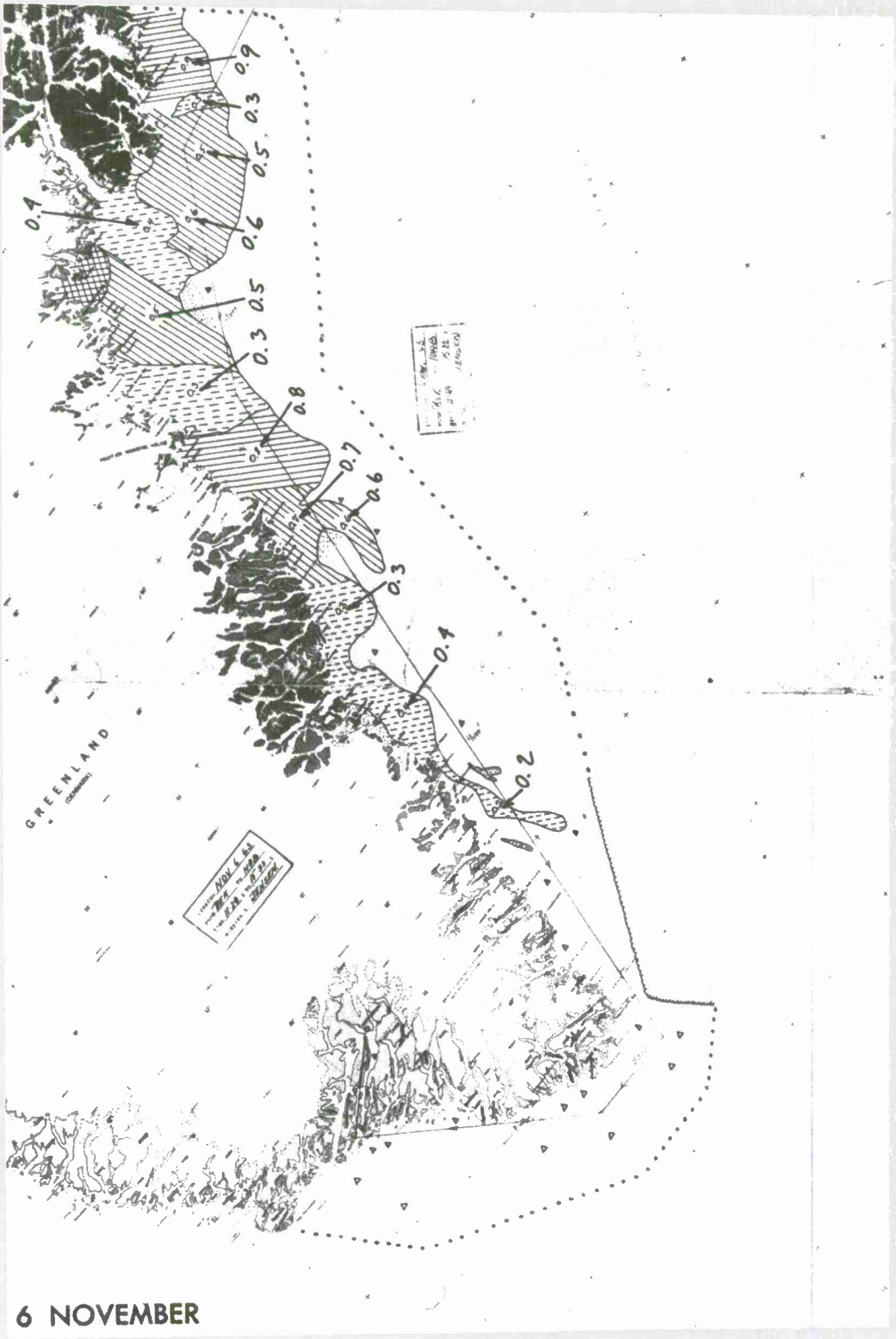
3 OCTOBER


3/210
1/100
5/410
3/300
GREENLAND
10 OCTOBER

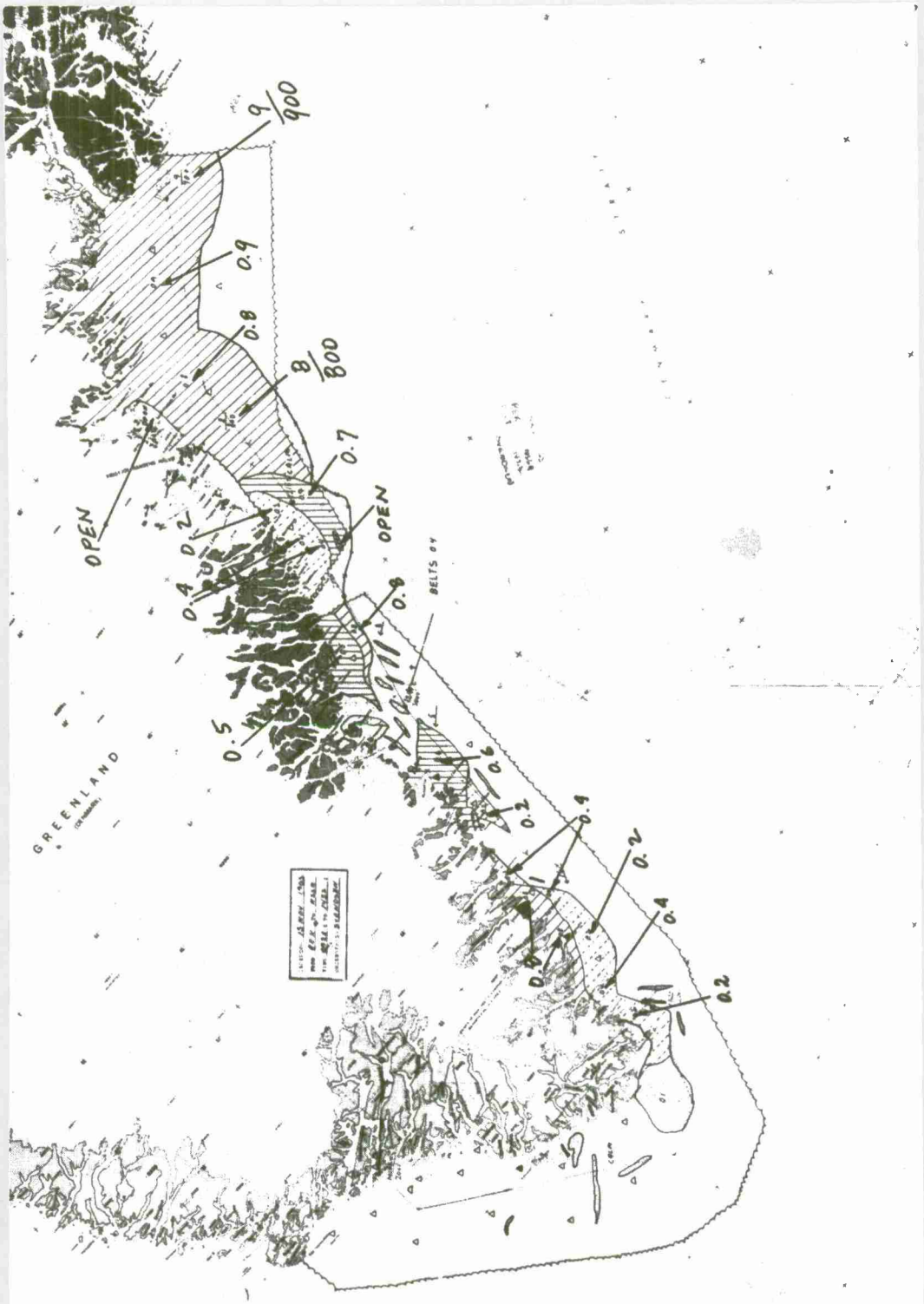


17 OCTOBER

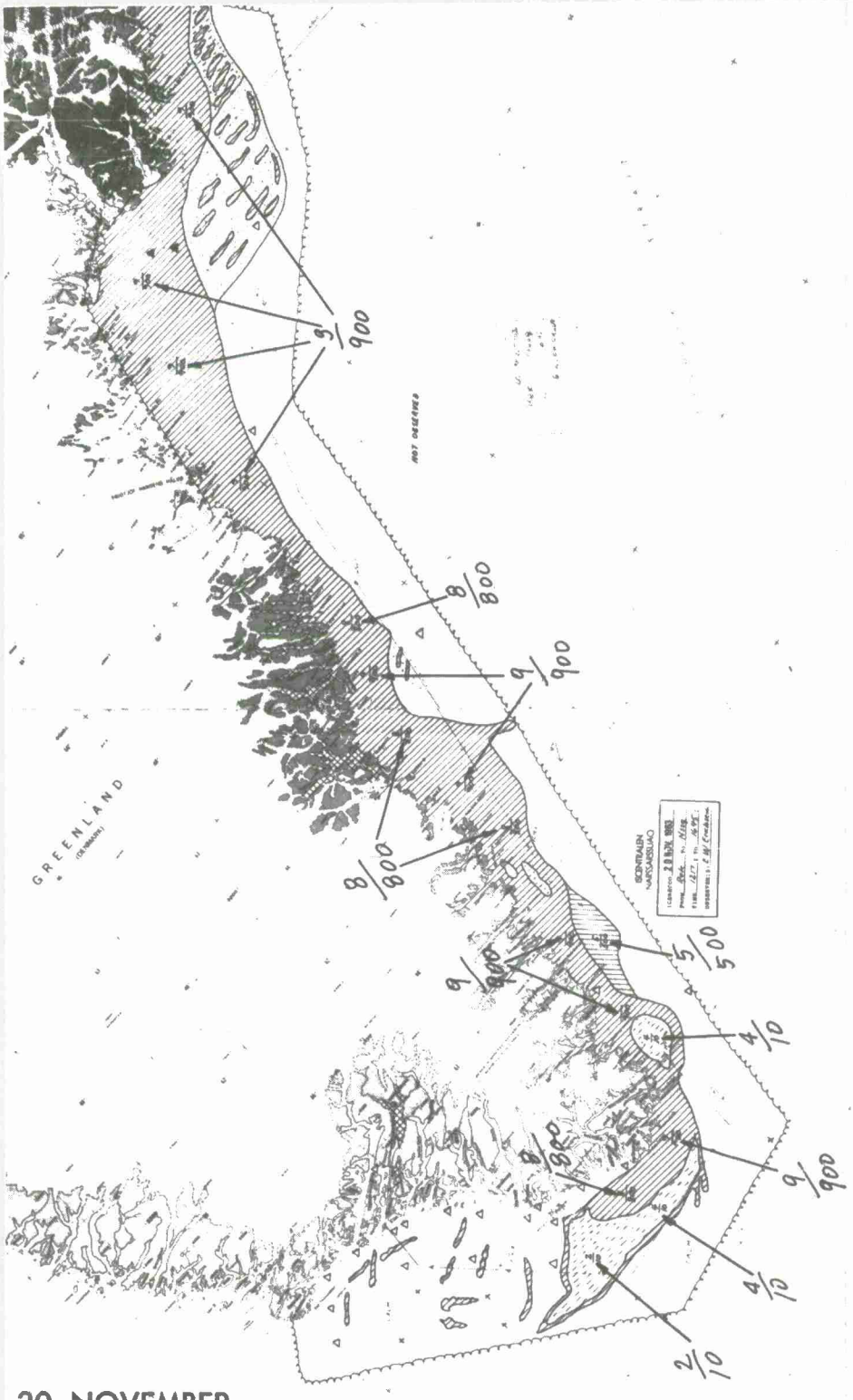

0.4
0.3
A/Y
23 OCTOBER



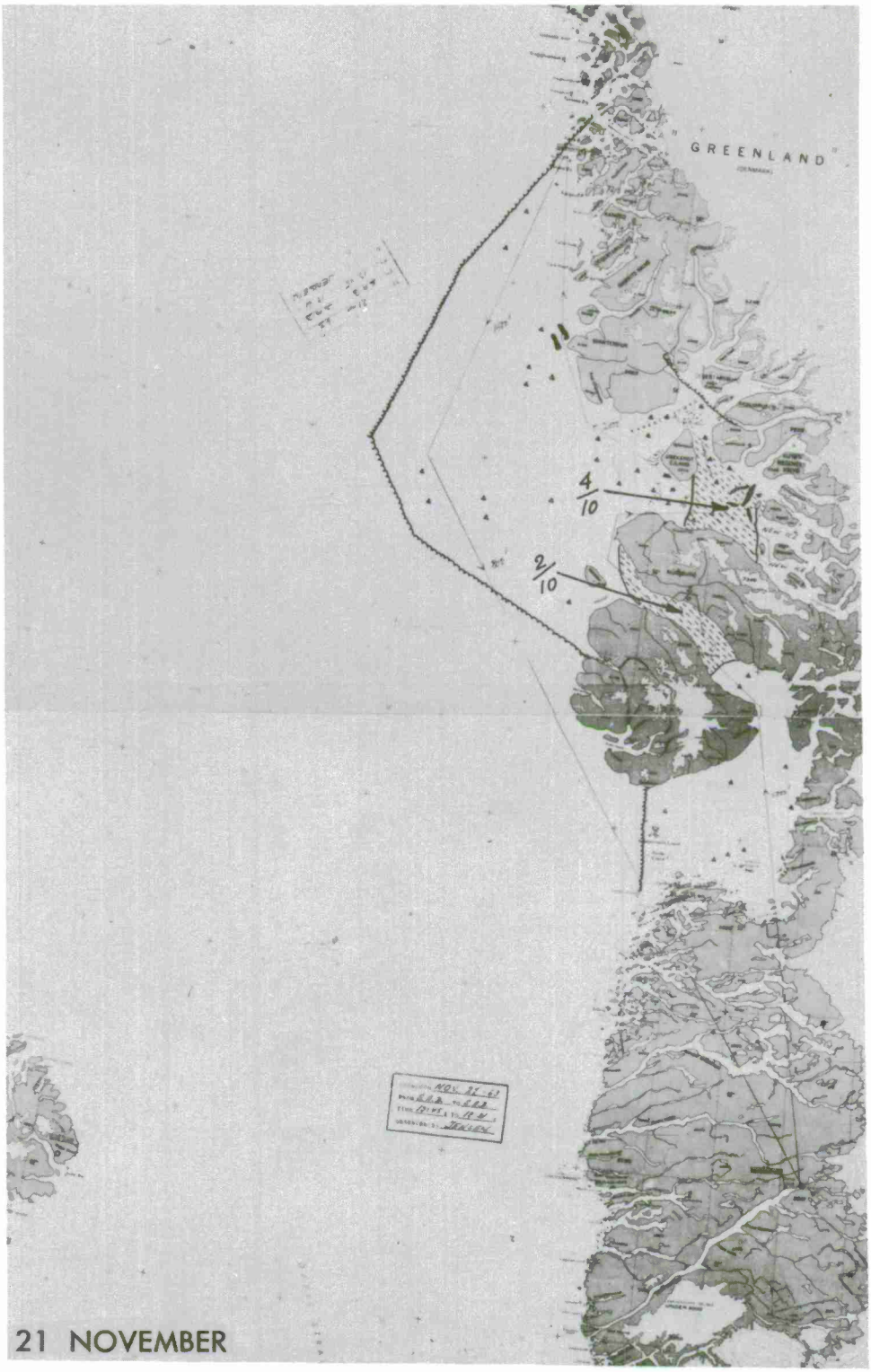
6 NOVEMBER


9/900
0.9
0.8
8/800
0.7
OPEN
OPEN
0.4
0.2
0.5
0.6
BELTS OF
GREENLAND
0.2
0.4
0.7
0.4
0.2

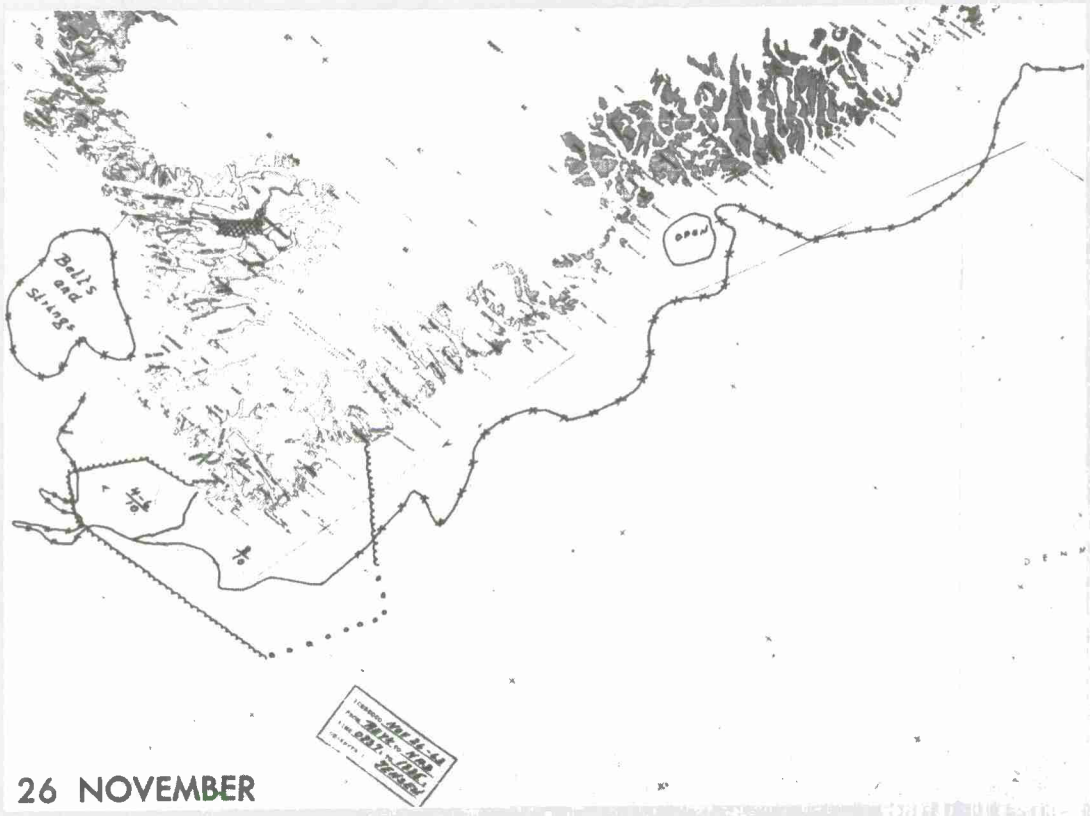
13 NOVEMBER


GREENLAND
(DENMARK)
9/900
8/800
9/900
8/800
9/900
5/500
4/10
9/900
4/10
2/10

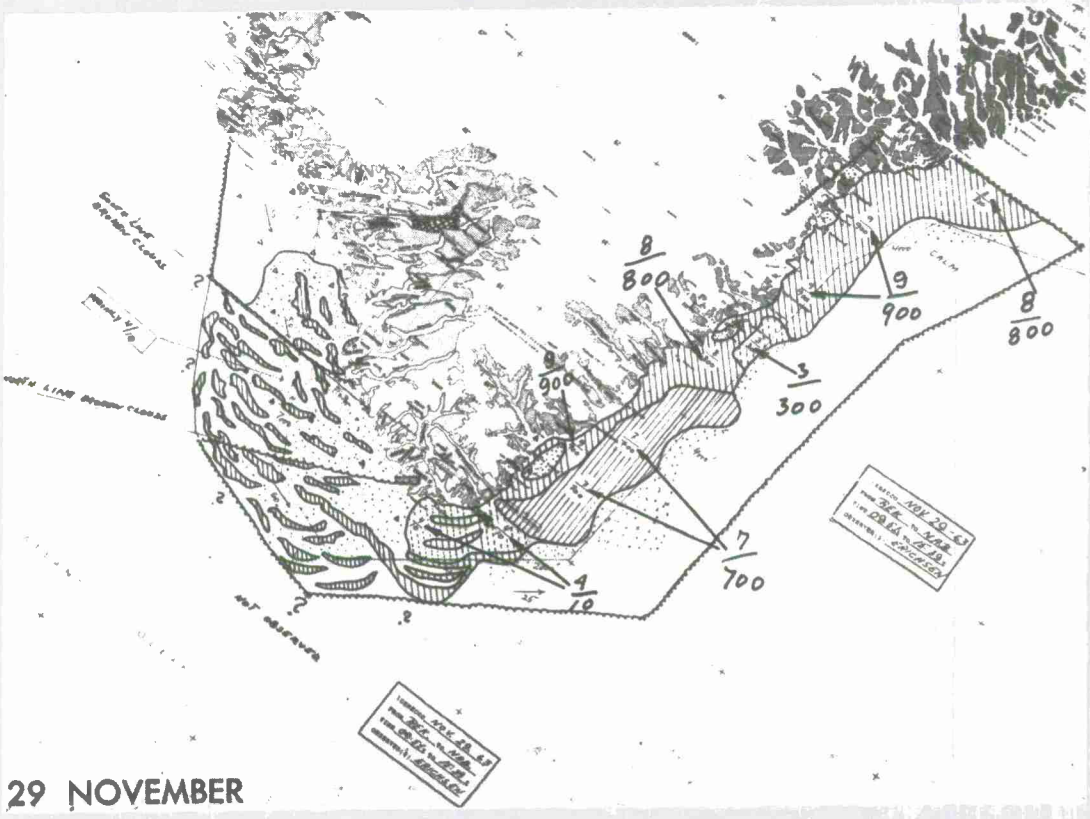
20 NOVEMBER



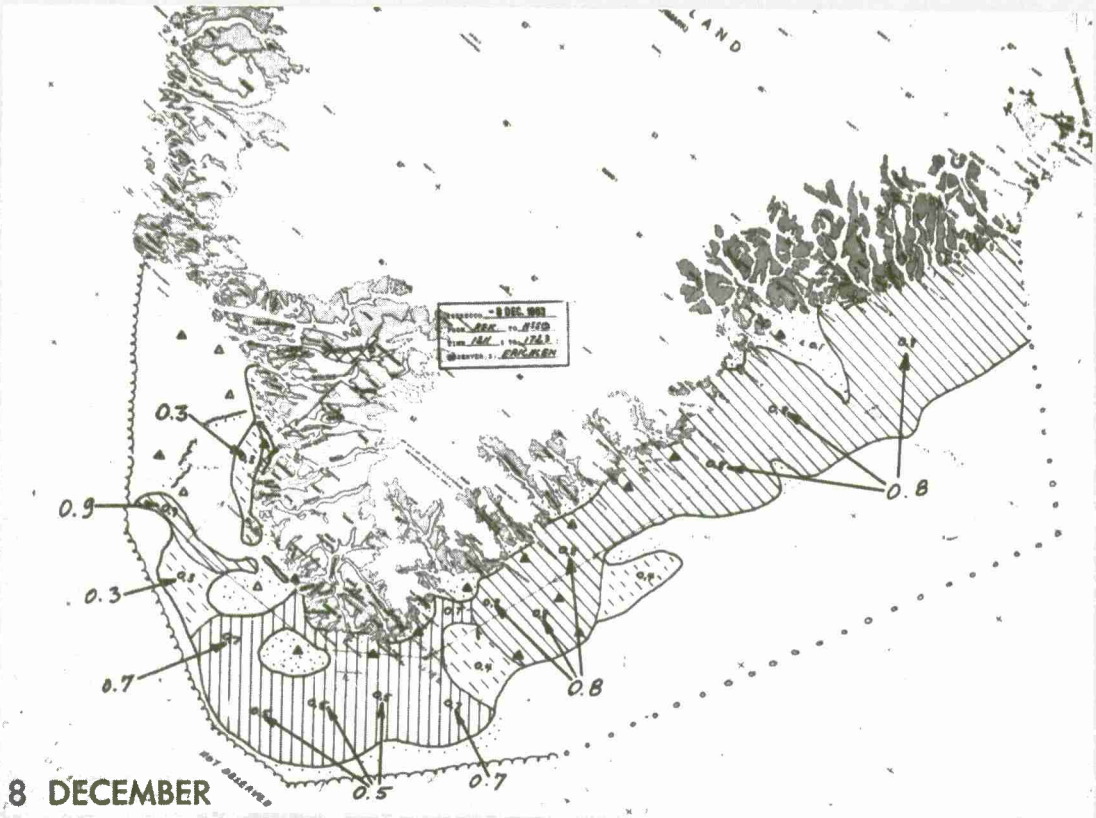
21 NOVEMBER



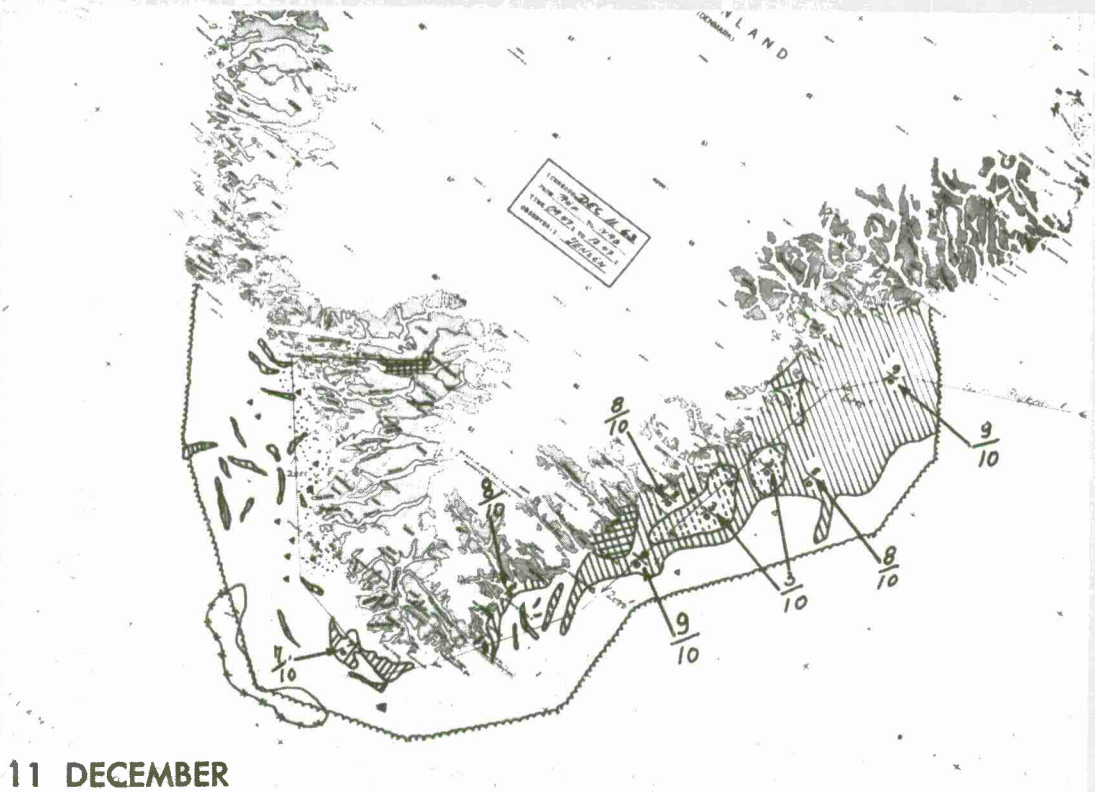
26 NOVEMBER



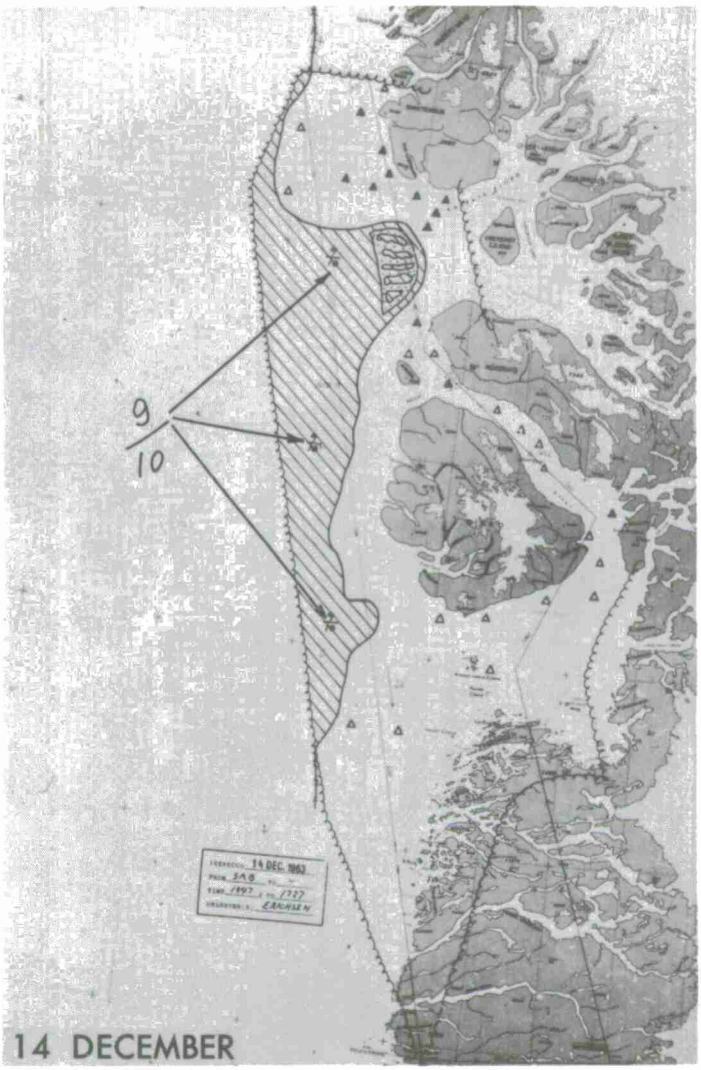
29 NOVEMBER

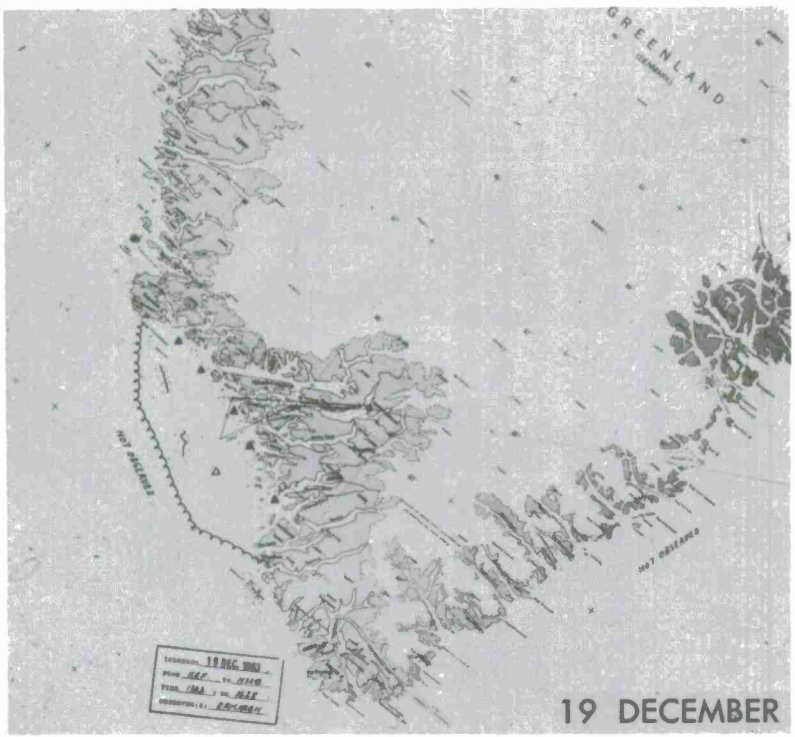


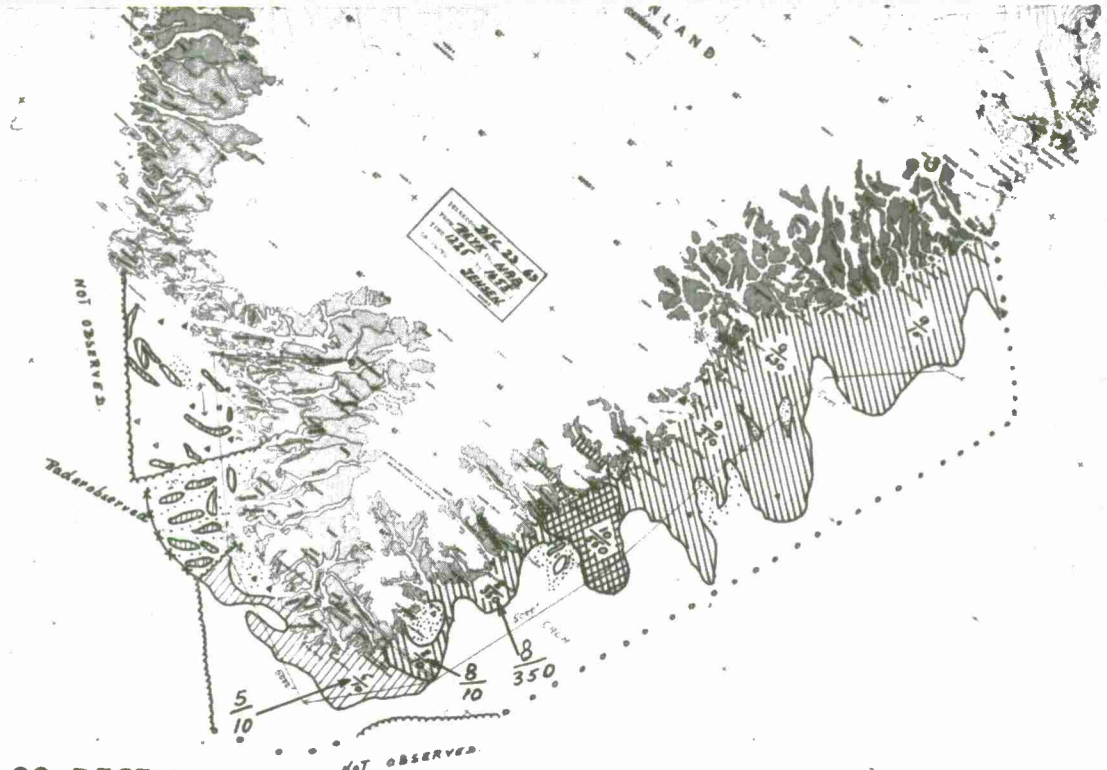
8 DECEMBER



11 DECEMBER


9
10
14 DECEMBER


GREENLAND
19 DECEMBER

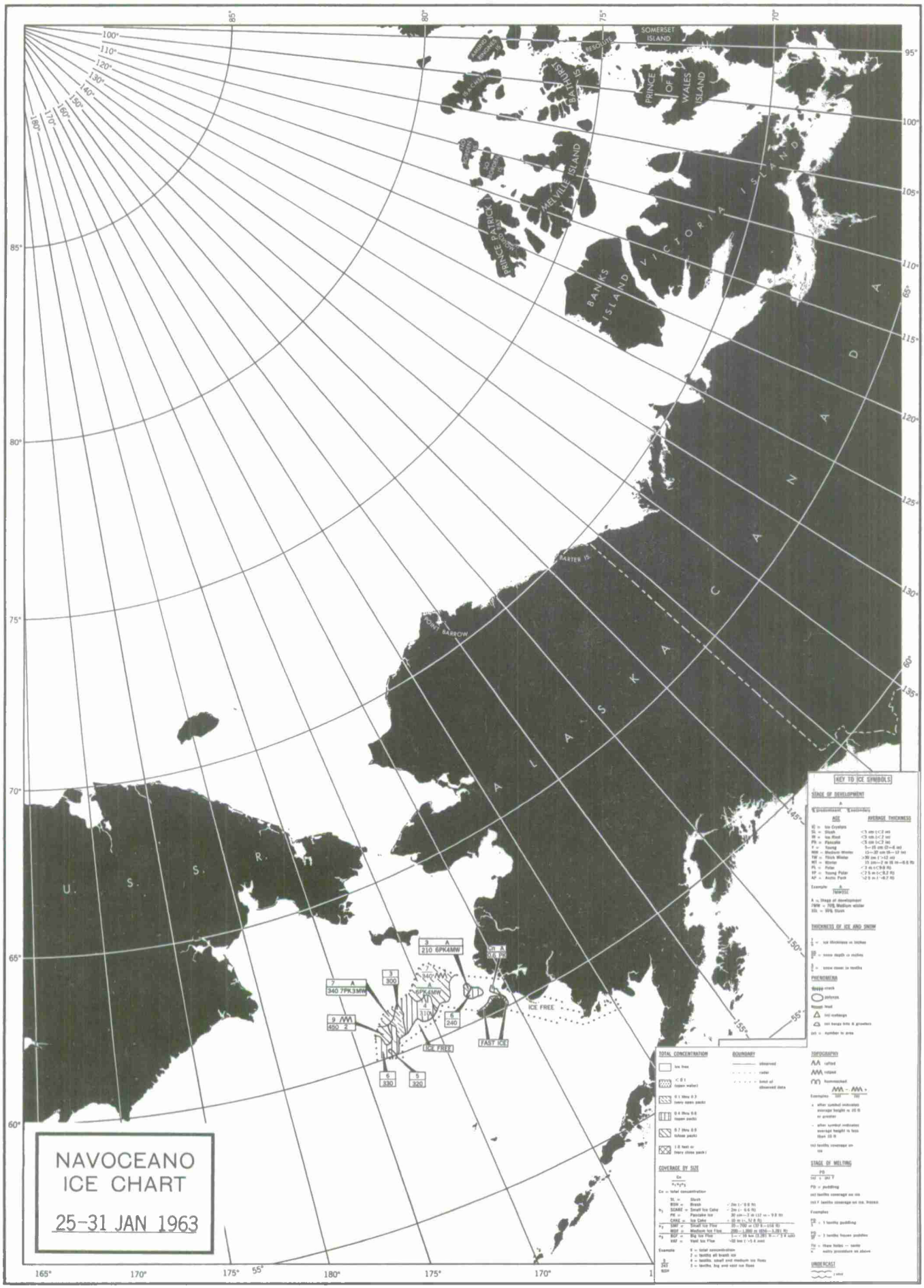


23 DECEMBER

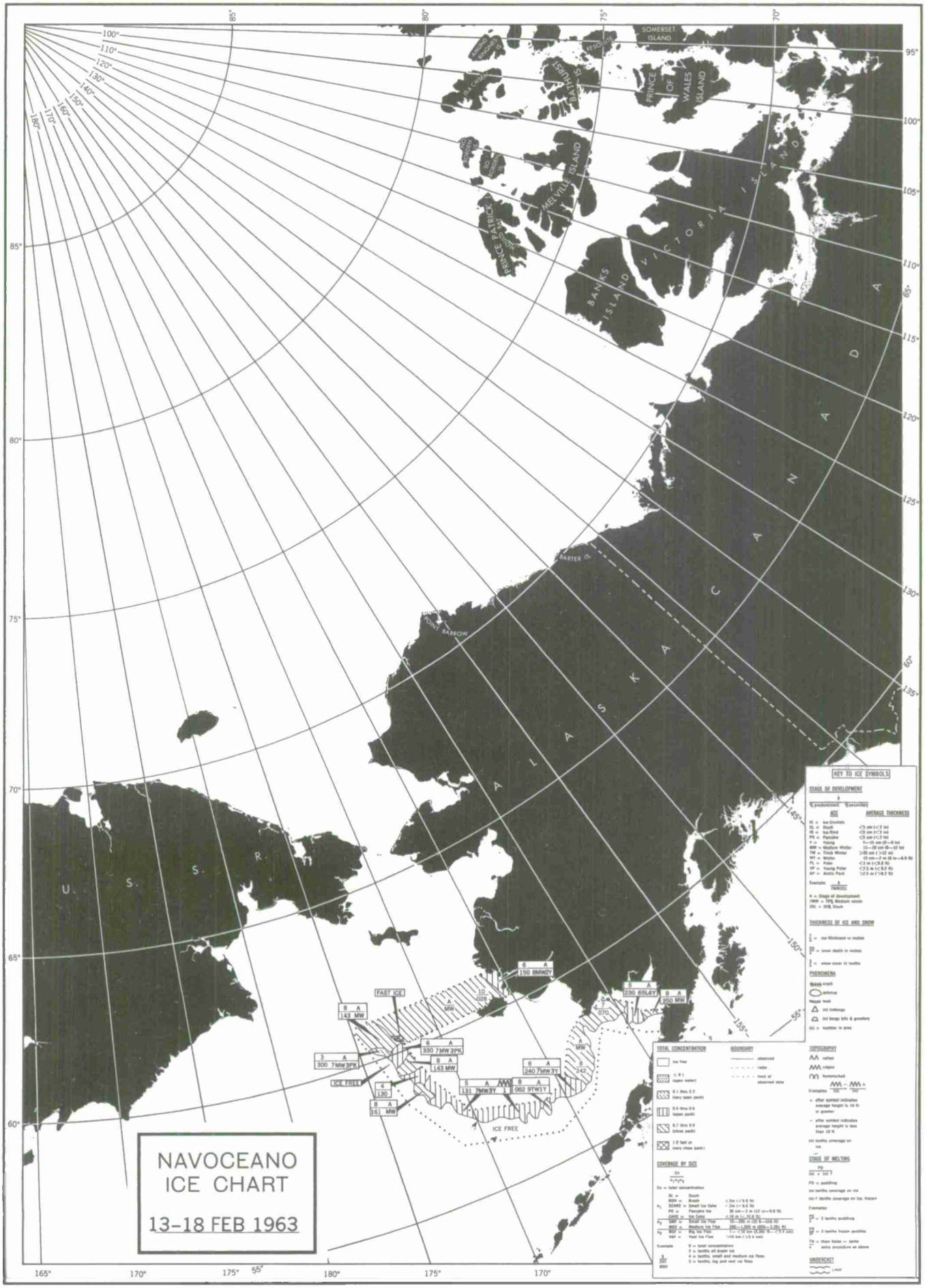
28 DECEMBER

APPENDIX C

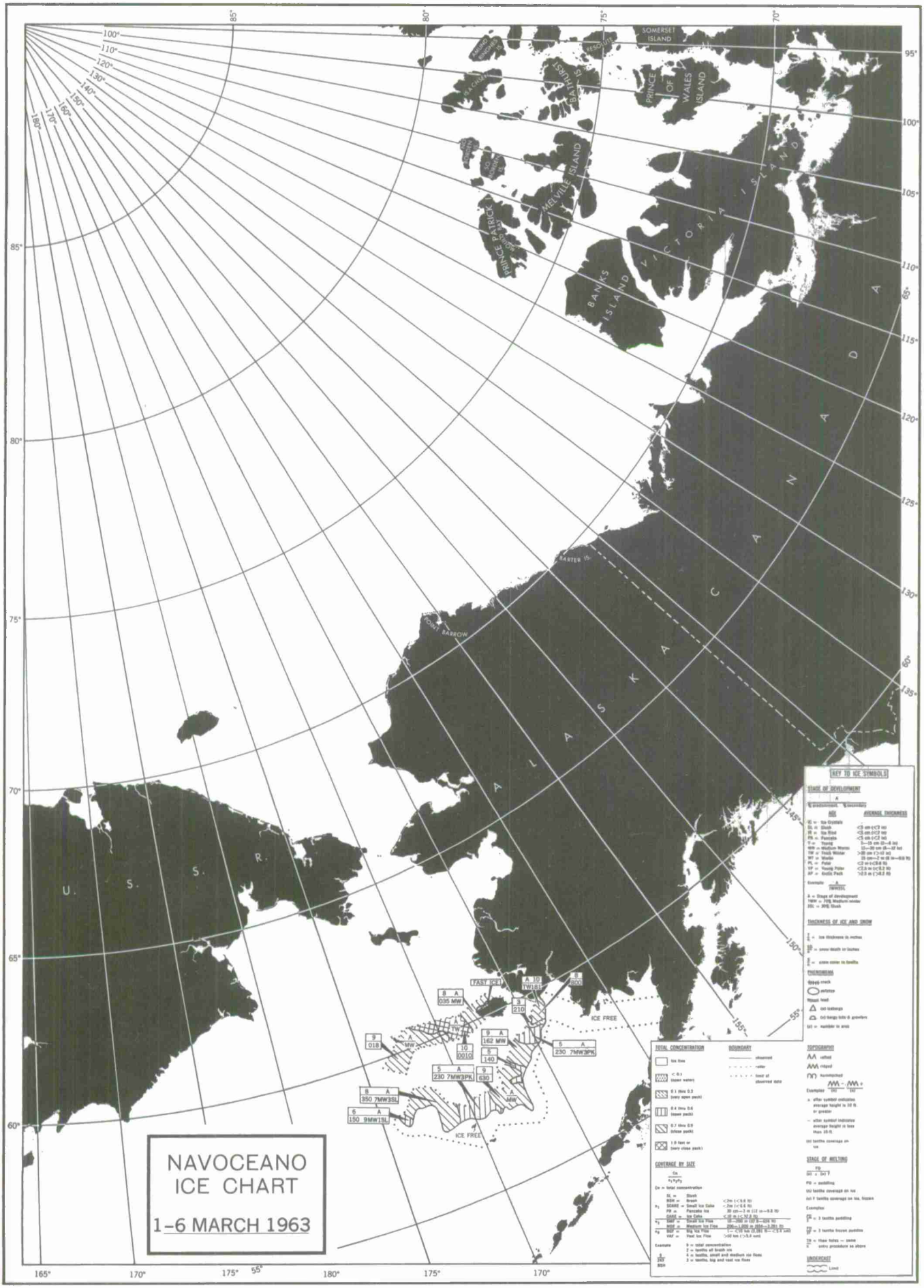
WESTERN ARCTIC ICE CHARTS

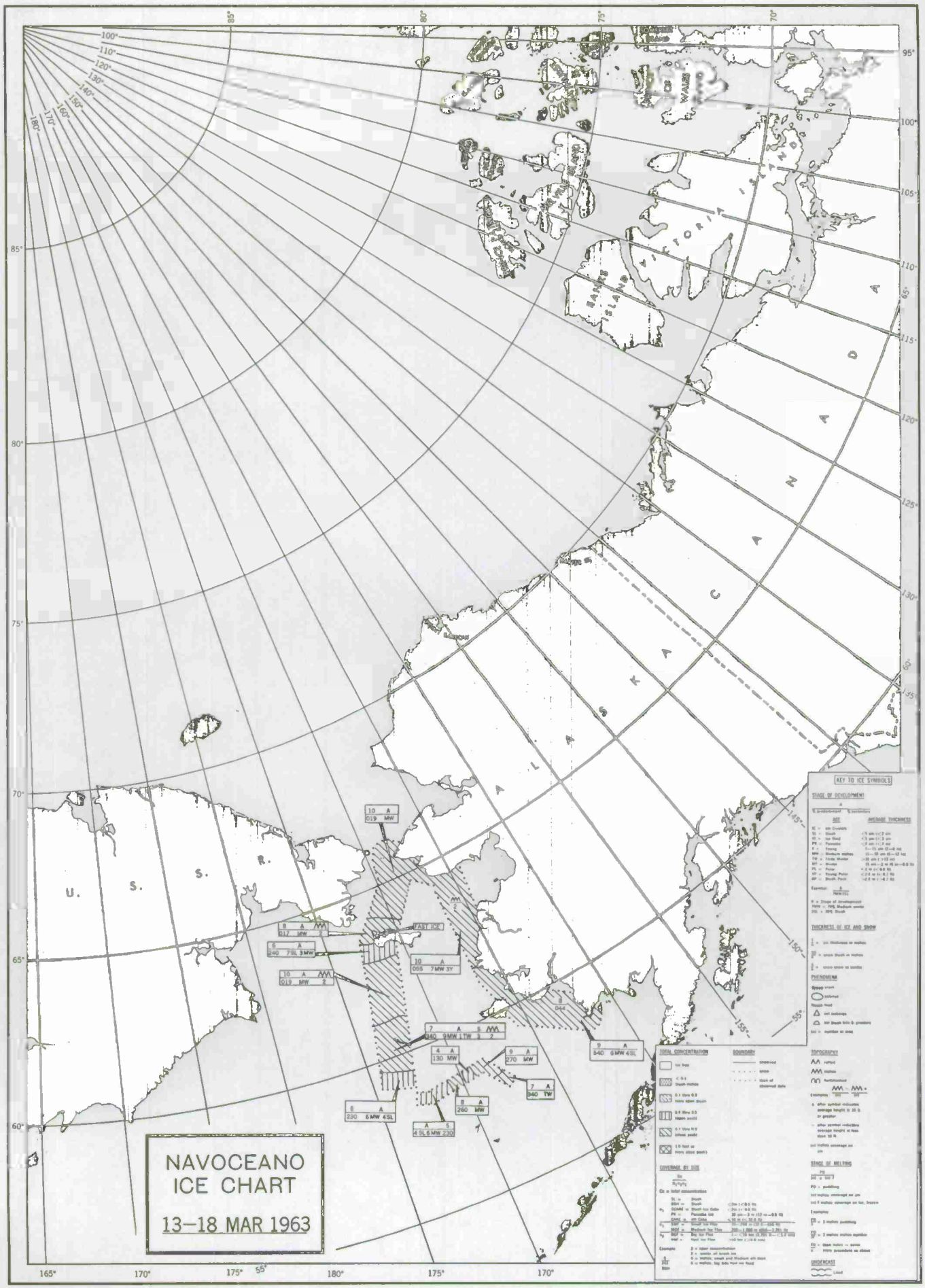

NAVOCEANO
ICE CHART
25-31 JAN 1963
SOMERSET ISLAND
PRINCE OF WALES ISLAND
MELVILLE ISLAND
BANKS ISLAND
VICTORIA ISLAND
CANADA
ALASKA
U. S. S. R.
BARTER IS.
POINT BARROW
ICE FREE
FAST ICE
KEY TO ICE SYMBOLS
STAGE OF DEVELOPMENT
AGE
AVERAGE THICKNESS
THICKNESS OF ICE AND SNOW
PHENOMENA
TOTAL CONCENTRATION
BOUNDARY
TOPOGRAPHY
COVERAGE BY SIZE
STAGE OF MELTING
UNDERCAST

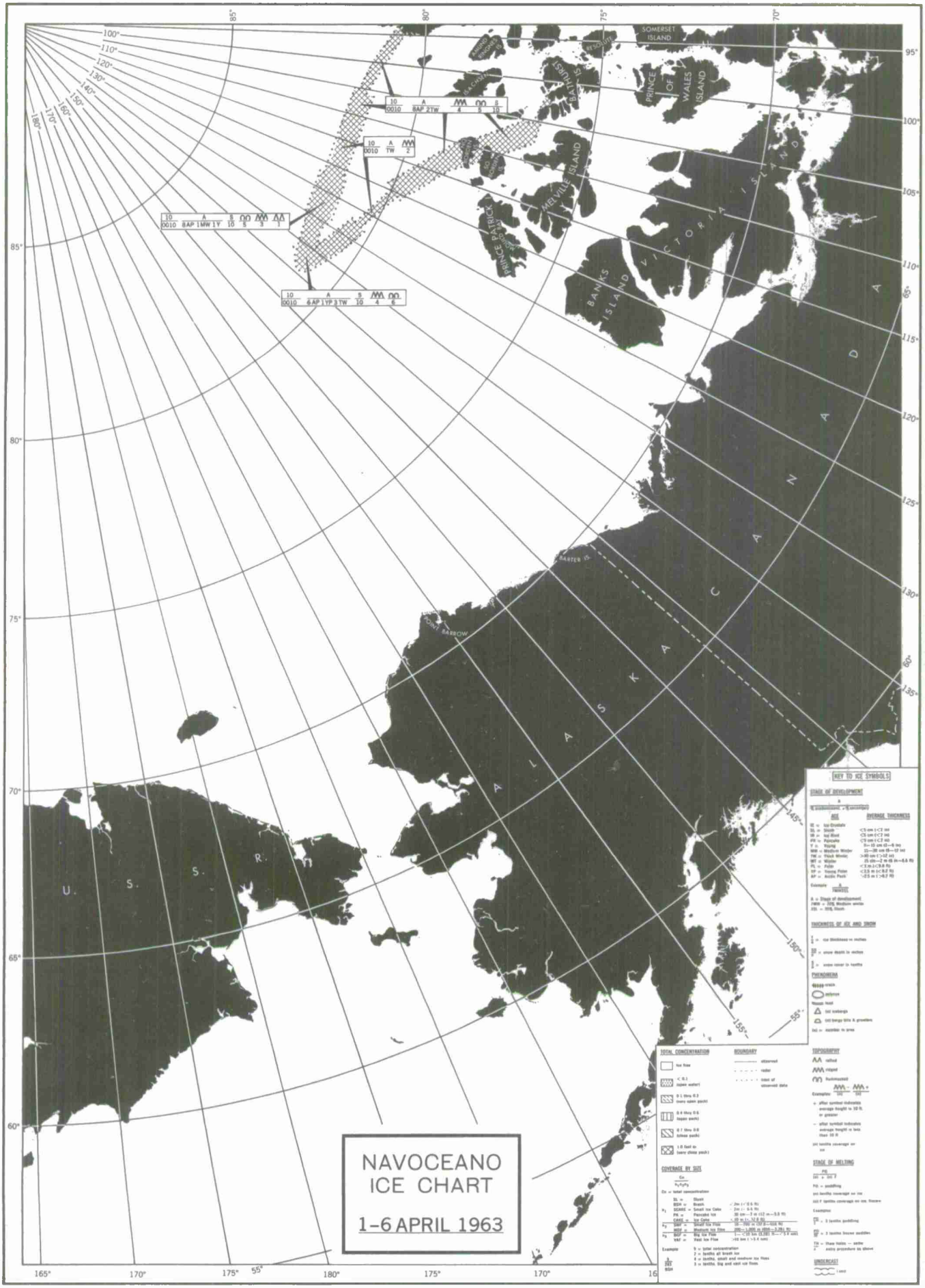

NAVOCEANO
ICE CHART
1-6 FEB 1963
SOMERSET ISLAND
PRINCE OF WALES ISLAND
BATHURST I.
MELVILLE ISLAND
PRINCE PATRICK ISLAND
BANKS ISLAND
VICTORIA ISLAND
CANADA
ALASKA
U.S.S.R.
BARTER IS.
POINT BARROW
FAST ICE
ICE FREE
KEY TO ICE SYMBOLS
STAGE OF DEVELOPMENT
AVERAGE THICKNESS
TOTAL CONCENTRATION
BOUNDARY
TOPOGRAPHY
COVERAGE BY SIZE
STAGE OF MELTING
UNDERCAST

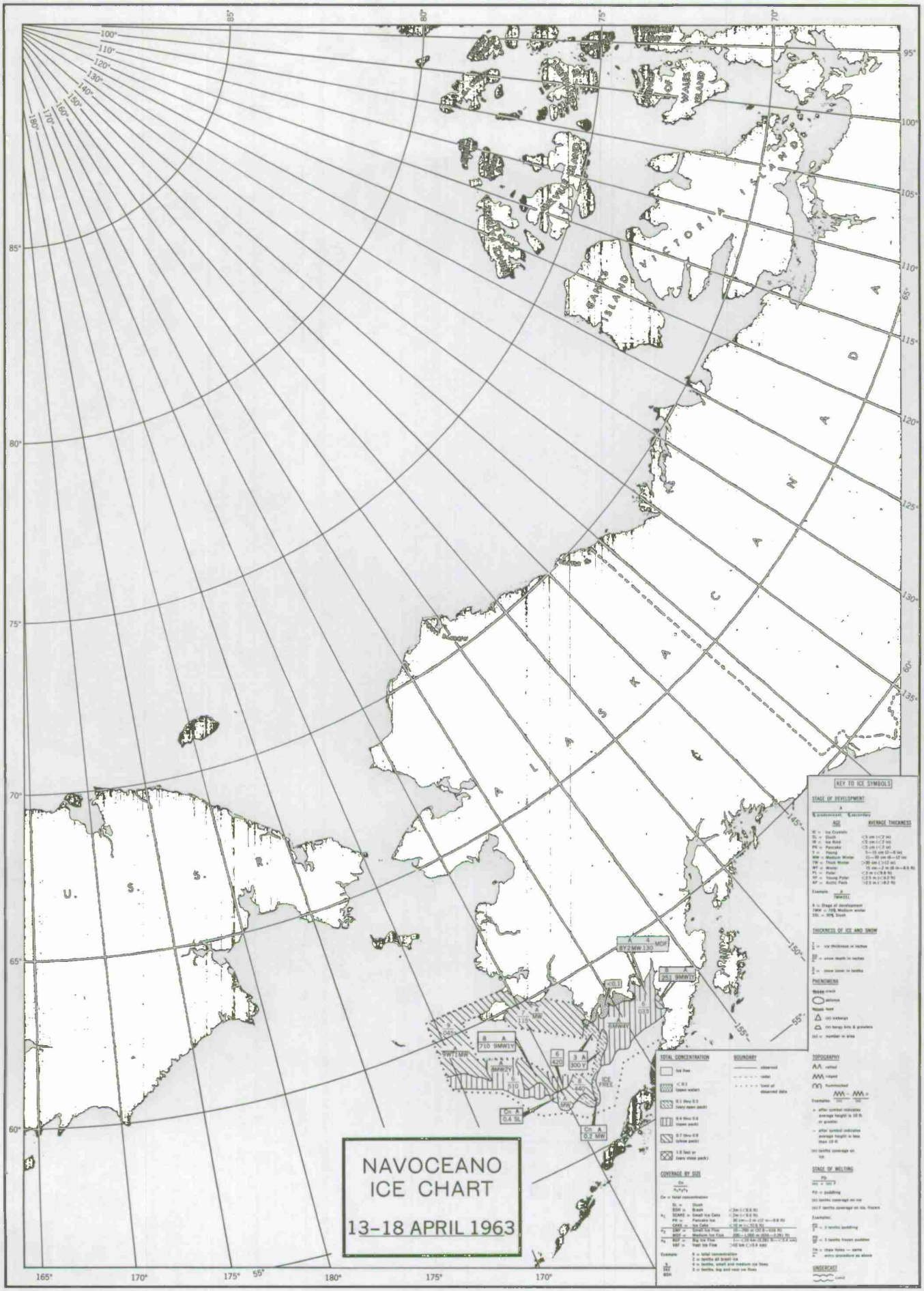

NAVOCEANO
ICE CHART
13–18 FEB 1963
SOMERSET ISLAND
PRINCE OF WALES ISLAND
VICTORIA ISLAND
BANKS ISLAND
MELVILLE ISLAND
PRINCE PATRICK ISLAND
CANADA
ALASKA
U. S. S. R.
POINT BARROW
BARTER IS.
FAST ICE
ICE FREE
KEY TO ICE SYMBOLS
STAGE OF DEVELOPMENT
AGE
AVERAGE THICKNESS
THICKNESS OF ICE AND SNOW
PHENOMENA
TOTAL CONCENTRATION
BOUNDARY
TOPOGRAPHY
COVERAGE BY SIZE
STAGE OF MELTING
UNDERCAST

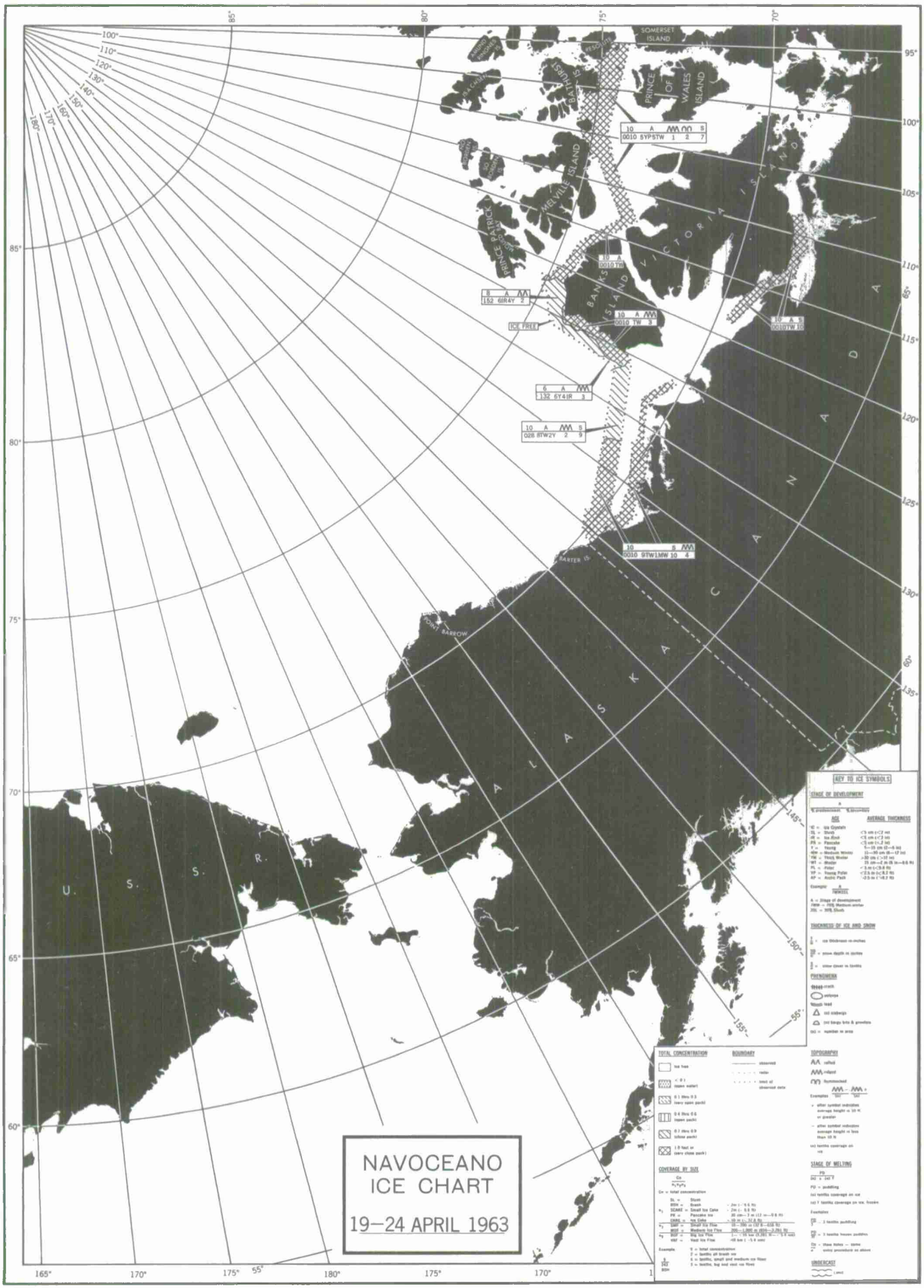

NAVOCEANO
ICE CHART
25-28 FEB 1963
SOMERSET ISLAND
PRINCE OF WALES ISLAND
VICTORIA ISLAND
BANKS ISLAND
MELVILLE ISLAND
PRINCE PATRICK ISLAND
BARTER IS.
POINT BARROW
ICE FREE
ALL AREAS NOT NOTED
KEY TO ICE SYMBOLS
STAGE OF DEVELOPMENT
AGE
AVERAGE THICKNESS
THICKNESS OF ICE AND SNOW
PHENOMENA
TOTAL CONCENTRATION
BOUNDARY
TOPOGRAPHY
COVERAGE BY SIZE
STAGE OF MELTING
UNDERCAST


NAVOCEANO
ICE CHART
1-6 MARCH 1963
SOMERSET ISLAND
PRINCE OF WALES ISLAND
MELVILLE ISLAND
BANKS ISLAND
VICTORIA ISLAND
CANADA
ALASKA
U. S. S. R.
BARTER IS.
POINT BARROW
FAST ICE
ICE FREE
KEY TO ICE SYMBOLS
STAGE OF DEVELOPMENT
AGE
AVERAGE THICKNESS
TOTAL CONCENTRATION
BOUNDARY
TOPOGRAPHY
COVERAGE BY SIZE
STAGE OF MELTING
UNDERCAST

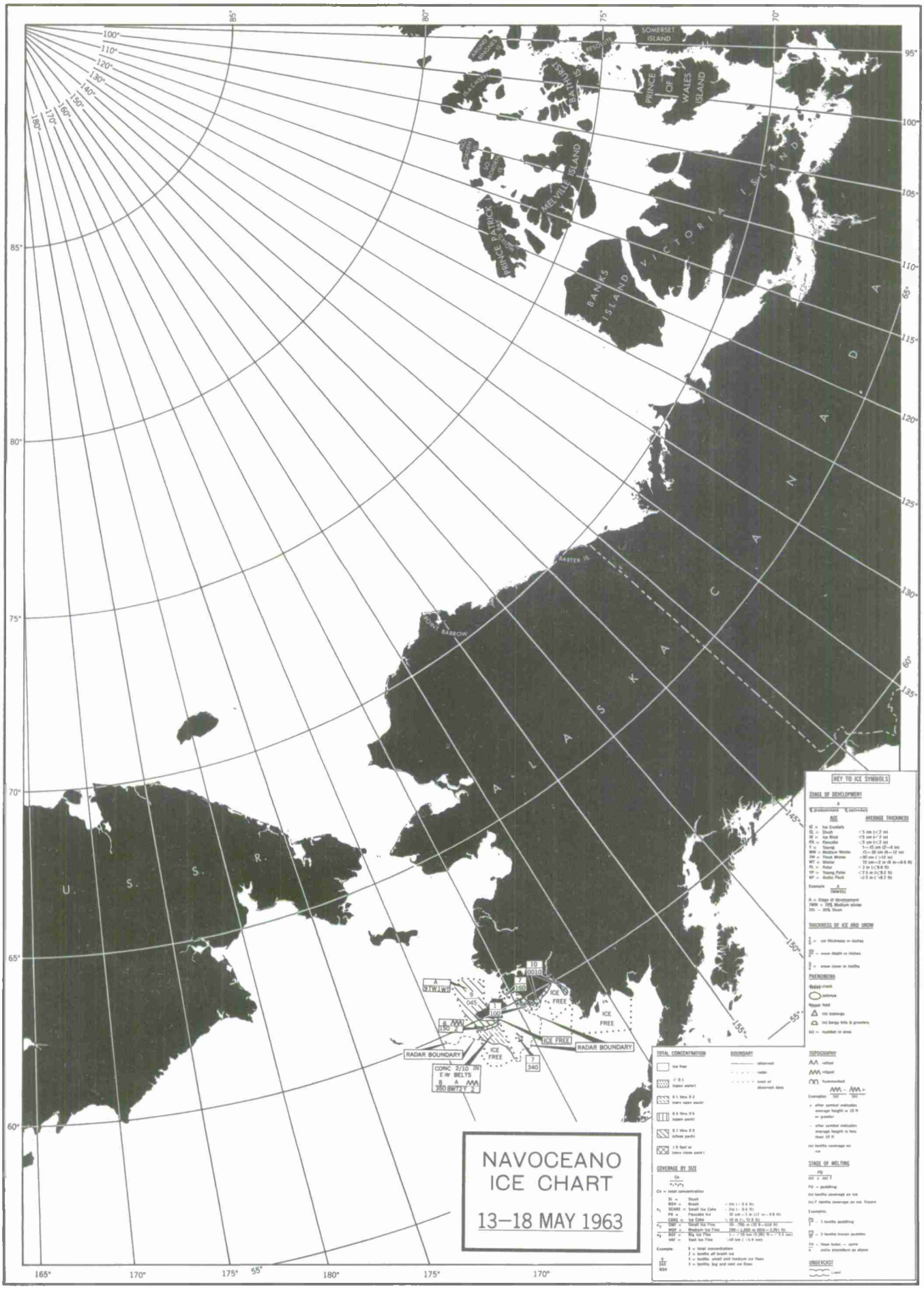

NAVOCEANO
ICE CHART
13–18 MAR 1963
U. S. S. R.
CANADA
ALASKA
BANKS ISLAND
VICTORIA ISLAND
WRANGEL ISLAND
FAST ICE
KEY TO ICE SYMBOLS
STAGE OF DEVELOPMENT
AGE
AVERAGE THICKNESS
THICKNESS OF ICE AND SNOW
PHENOMENA
TOTAL CONCENTRATION
BOUNDARY
TOPOGRAPHY
COVERAGE BY SIZE
STAGE OF MELTING
UNDERCAST

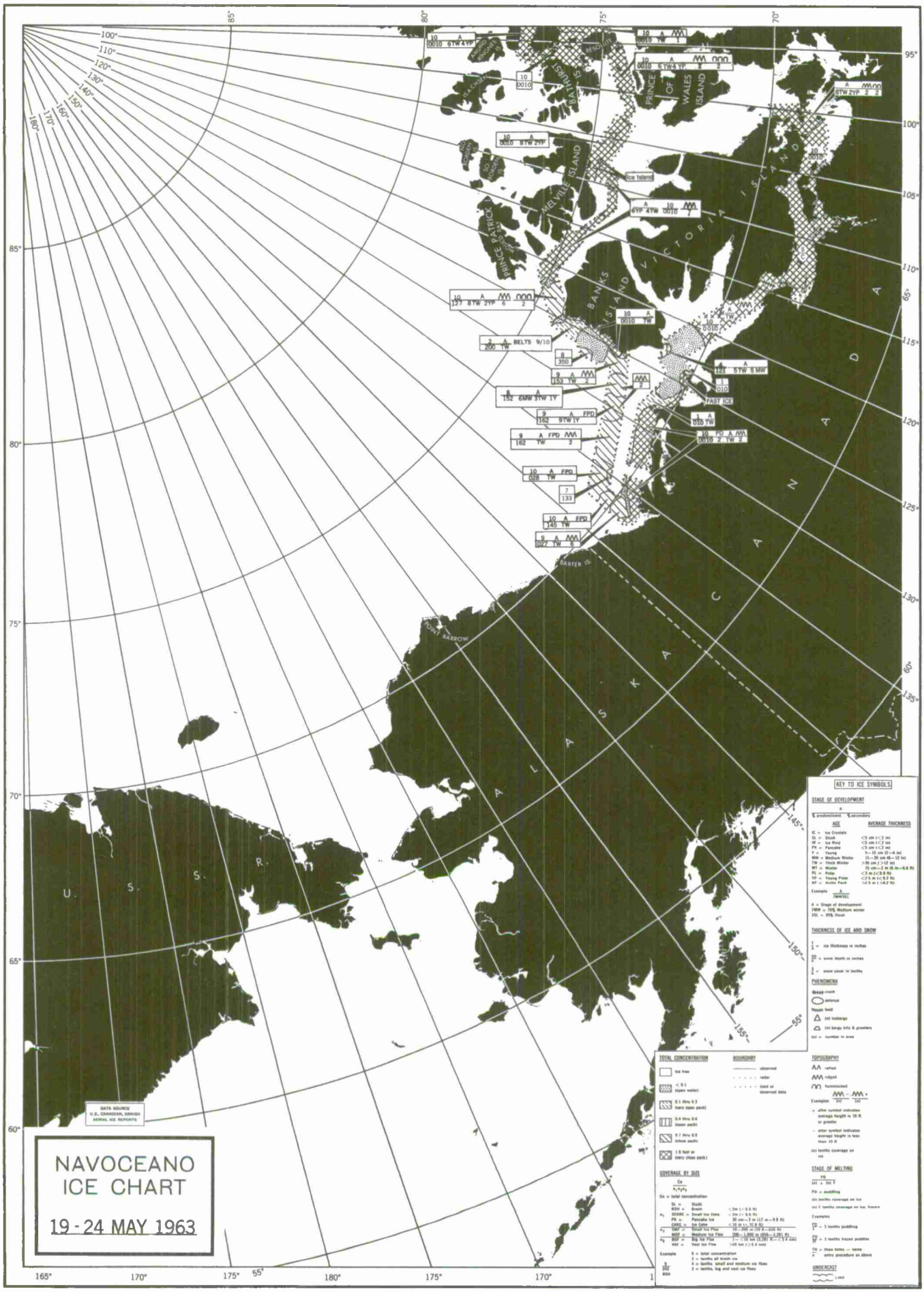

NAVOCEANO
ICE CHART
1-6 APRIL 1963
KEY TO ICE SYMBOLS
SOMERSET ISLAND
PRINCE OF WALES ISLAND
VICTORIA ISLAND
BANKS ISLAND
MELVILLE ISLAND
PRINCE PATRICK ISLAND
BARTER IS.
POINT BARROW
A L A S K A
C A N A D A
U. S. S. R.

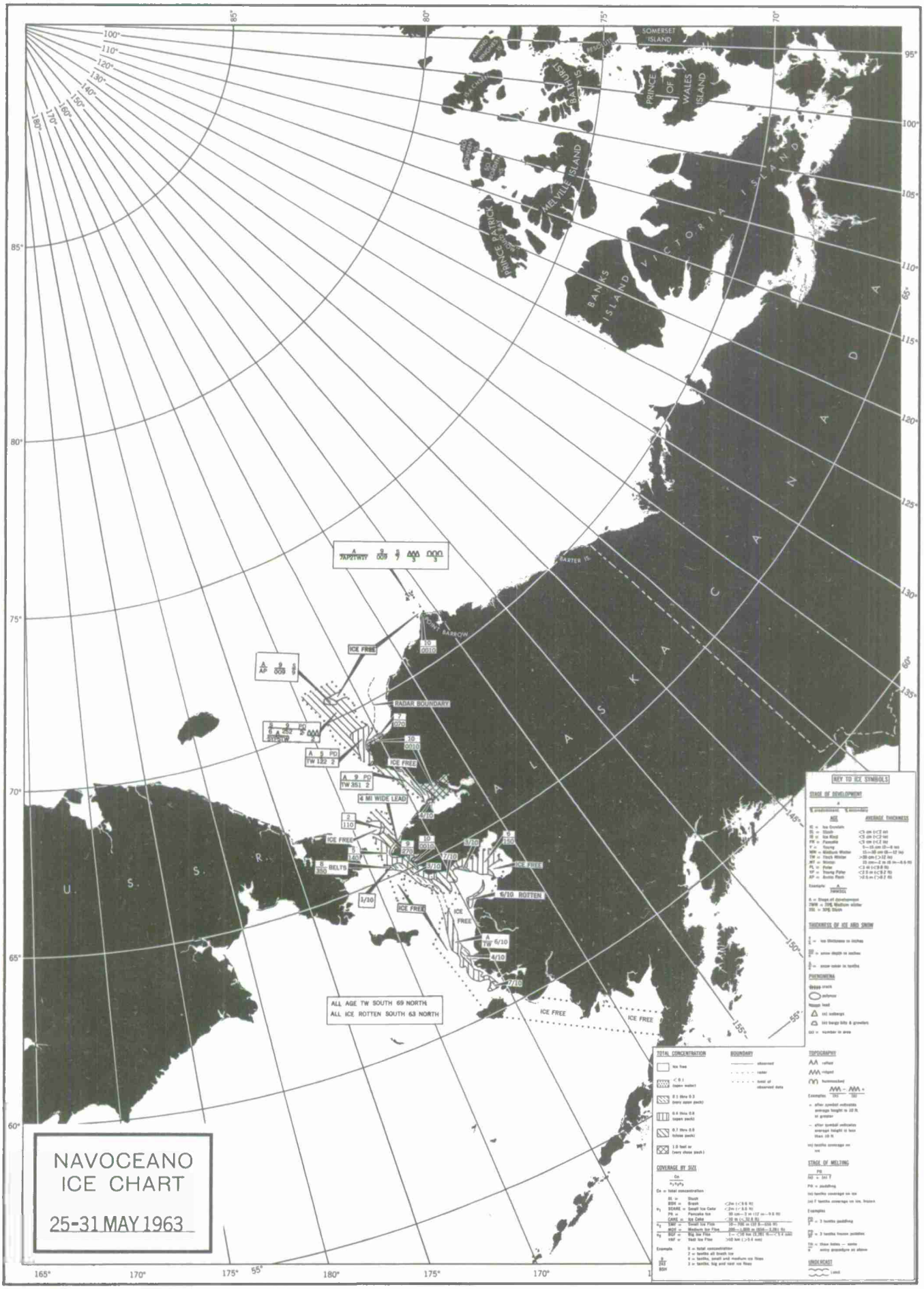

NAVOCEANO
ICE CHART
13-18 APRIL 1963
KEY TO ICE SYMBOLS
U. S. S. R.
A L A S K A
C A N A D A
BANKS ISLAND
VICTORIA ISLAND
PRINCE OF WALES ISLAND

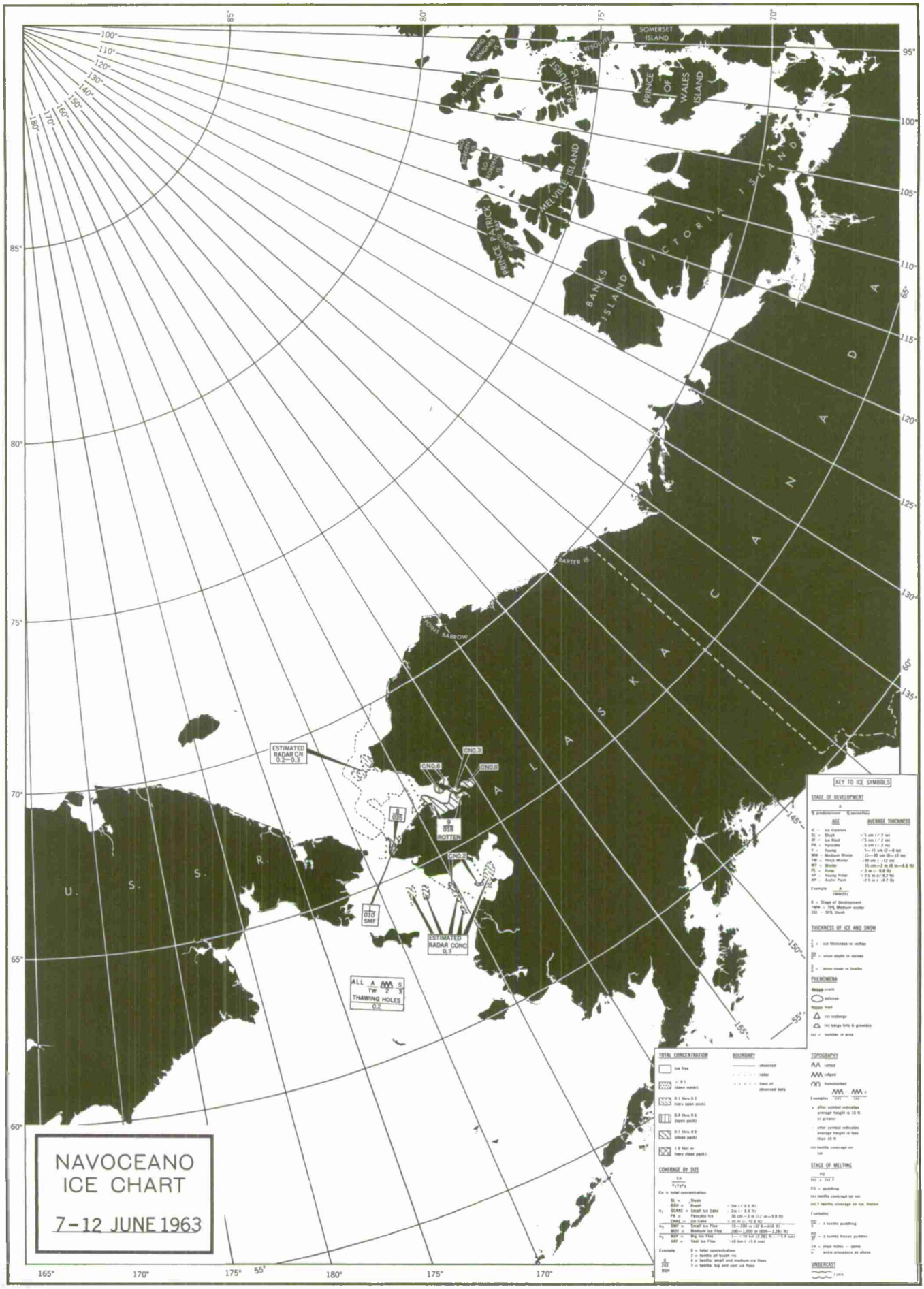

NAVOCEANO
ICE CHART
19—24 APRIL 1963
SOMERSET ISLAND
PRINCE OF WALES ISLAND
MELVILLE ISLAND
BANKS ISLAND
VICTORIA ISLAND
PRINCE PATRICK ISLAND
CANADA
ALASKA
U. S. S. R.
POINT BARROW
BARTER IS.
ICE FREE
KEY TO ICE SYMBOLS
STAGE OF DEVELOPMENT
AGE
AVERAGE THICKNESS
TOTAL CONCENTRATION
BOUNDARY
TOPOGRAPHY
STAGE OF MELTING
COVERAGE BY SIZE
UNDERCAST

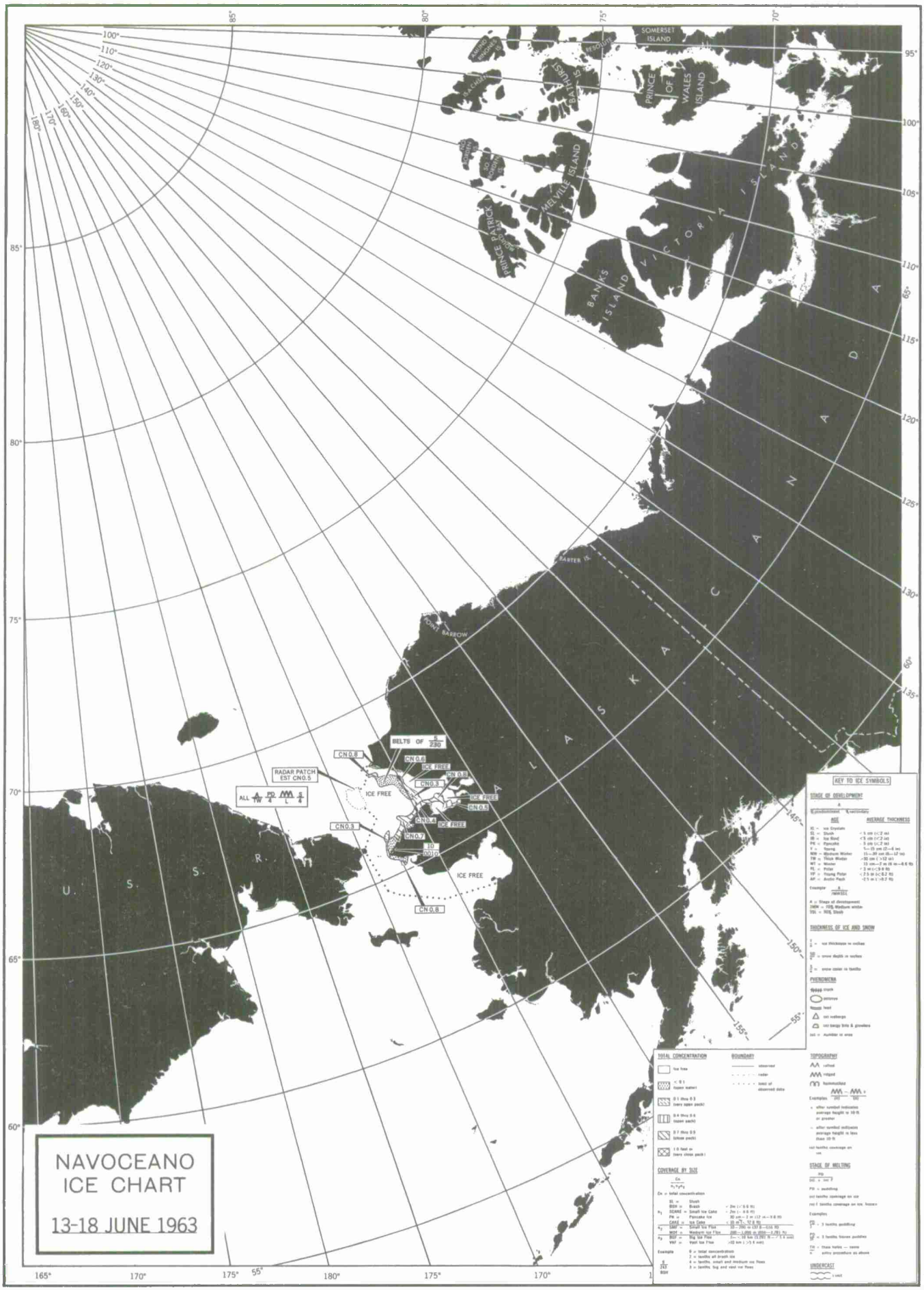

NAVOCEANO
ICE CHART
25-30 APRIL 1963
SOMERSET ISLAND
PRINCE OF WALES ISLAND
MELVILLE ISLAND
PRINCE PATRICK ISLAND
BANKS ISLAND
VICTORIA ISLAND
CANADA
ALASKA
U. S. S. R.
BARTER IS.
POINT BARROW
FAST ICE
ICE FREE
COAST
RADAR BOUNDARY
ALL AGES NOT NOTED
KEY TO ICE SYMBOLS
STAGE OF DEVELOPMENT
AGE
AVERAGE THICKNESS
THICKNESS OF ICE AND SNOW
PHENOMENA
TOTAL CONCENTRATION
BOUNDARY
TOPOGRAPHY
COVERAGE BY SIZE
STAGE OF MELTING
UNDERCAST


NAVOCEANO
ICE CHART
13–18 MAY 1963
SOMERSET ISLAND
PRINCE OF WALES ISLAND
MELVILLE ISLAND
BANKS ISLAND
VICTORIA ISLAND
CANADA
ALASKA
U. S. S. R.
BARTER IS
POINT BARROW
RADAR BOUNDARY
ICE FREE
CONC 3/10 IN E-W BELTS
KEY TO ICE SYMBOLS
TOTAL CONCENTRATION
BOUNDARY
COVERAGE BY SIZE
STAGE OF DEVELOPMENT
AGE
AVERAGE THICKNESS
THICKNESS OF ICE AND SNOW
PHENOMENA
TOPOGRAPHY
STAGE OF MELTING
UNDERCAST

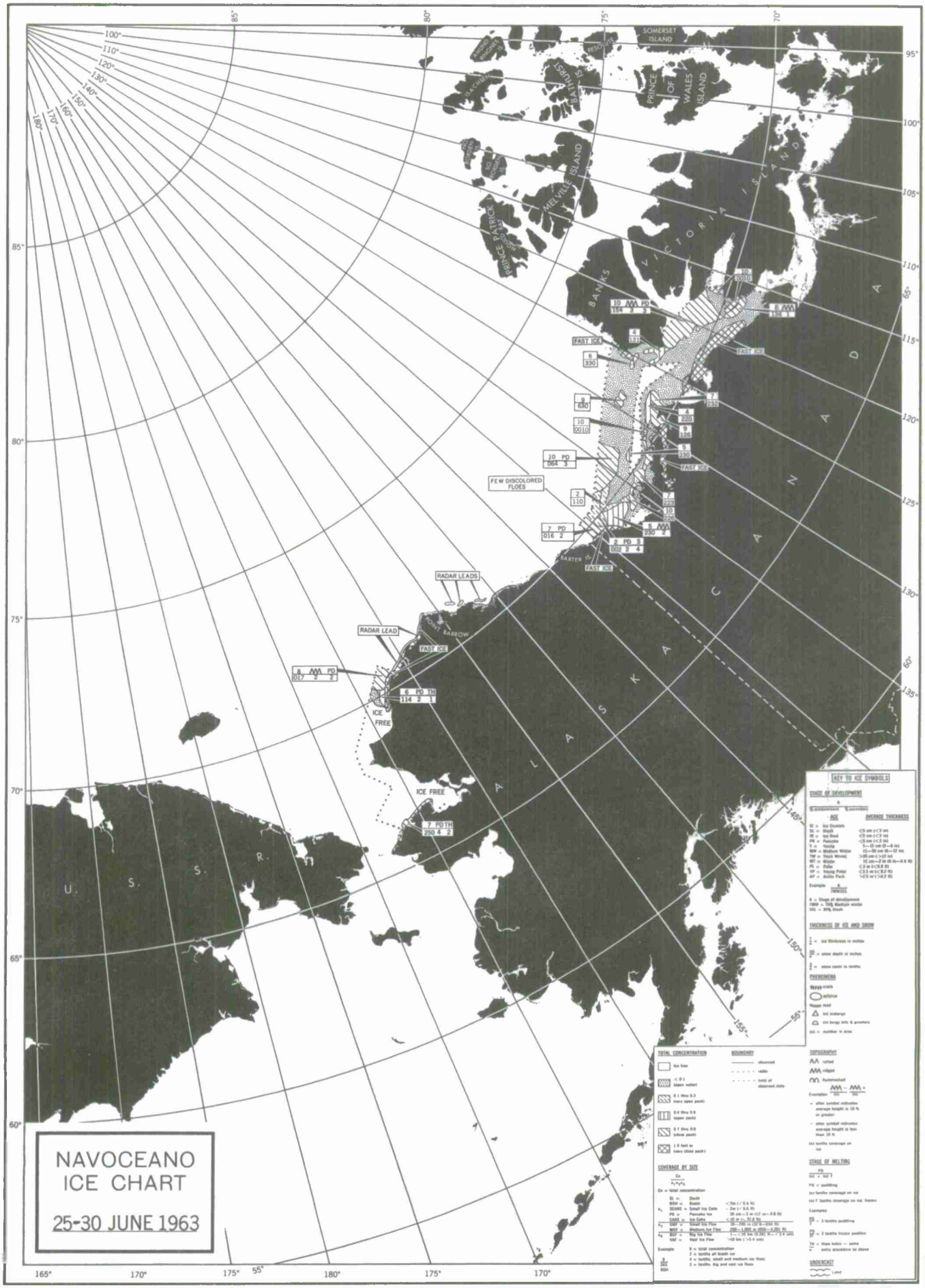

NAVOCEANO
ICE CHART
19 - 24 MAY 1963
KEY TO ICE SYMBOLS
DATA SOURCE
U.S., CANADIAN, DANISH
AERIAL ICE REPORTS
PRINCE OF WALES ISLAND
VICTORIA ISLAND
BANKS ISLAND
MELVILLE ISLAND
PRINCE PATRICK ISLAND
ELLESMERE ISLAND
Ice Island
FAST ICE
POINT BARROW
BARTER
U. S. S. R.
A L A S K A
C A N A D A

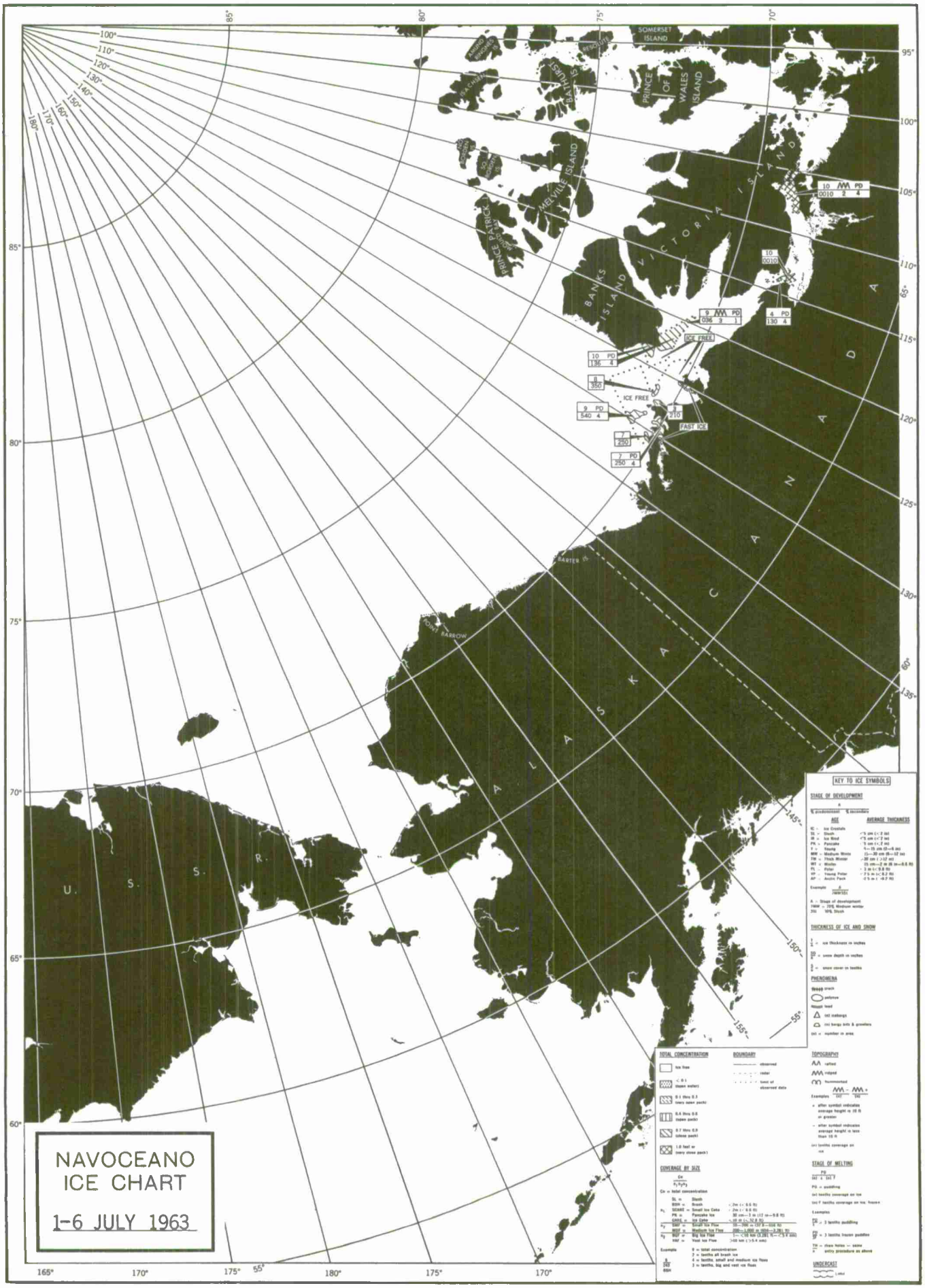

NAVOCEANO
ICE CHART
25-31 MAY 1963
ALL AGE TW SOUTH 69 NORTH
ALL ICE ROTTEN SOUTH 63 NORTH
ICE FREE
RADAR BOUNDARY
4 MI WIDE LEAD
6/10 ROTTEN
BELTS
SOMERSET ISLAND
PRINCE OF WALES ISLAND
VICTORIA ISLAND
BANKS ISLAND
MELVILLE ISLAND
PRINCE PATRICK ISLAND
BARROW
BARTER IS.
ALASKA
CANADA
U.S.S.R.
KEY TO ICE SYMBOLS
STAGE OF DEVELOPMENT
AVERAGE THICKNESS
TOTAL CONCENTRATION
BOUNDARY
TOPOGRAPHY
COVERAGE BY SIZE
STAGE OF MELTING
UNDERCAST

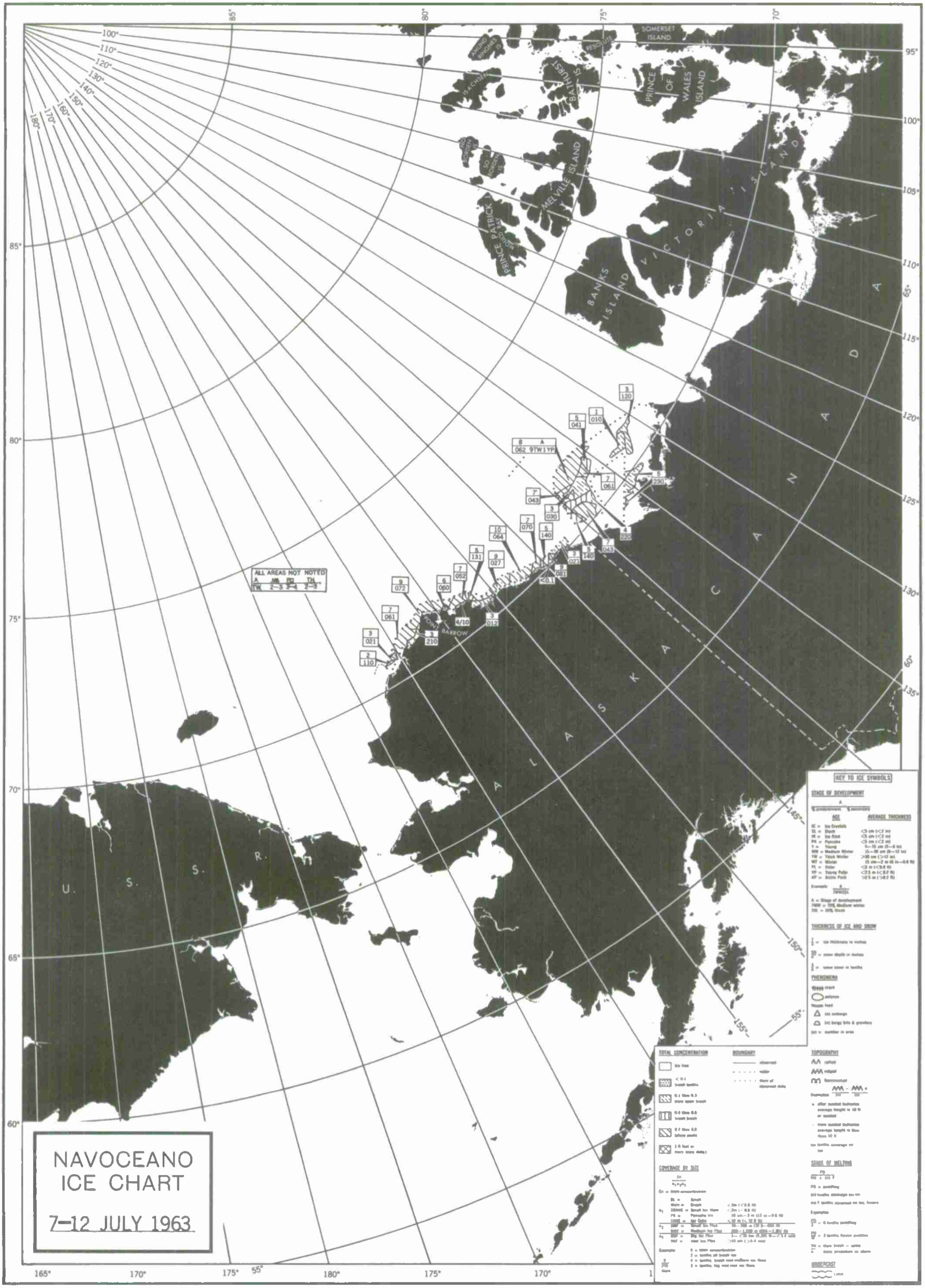

NAVOCEANO
ICE CHART
7–12 JUNE 1963
SOMERSET ISLAND
PRINCE OF WALES ISLAND
MELVILLE ISLAND
PRINCE PATRICK ISLAND
BANKS ISLAND
VICTORIA ISLAND
CANADA
ALASKA
U. S. S. R.
BARTER IS.
POINT BARROW
ESTIMATED RADAR C/N 0.2–0.3
C/NO.6
C/NO.3
C/NO.5
C/NO.8
ESTIMATED RADAR CONC 0.3
ALL A TW 2 3
THAWING HOLES
0.2
KEY TO ICE SYMBOLS
STAGE OF DEVELOPMENT
AGE
AVERAGE THICKNESS
THICKNESS OF ICE AND SNOW
PHENOMENA
TOTAL CONCENTRATION
BOUNDARY
TOPOGRAPHY
COVERAGE BY SIZE
STAGE OF MELTING
UNDERCAST

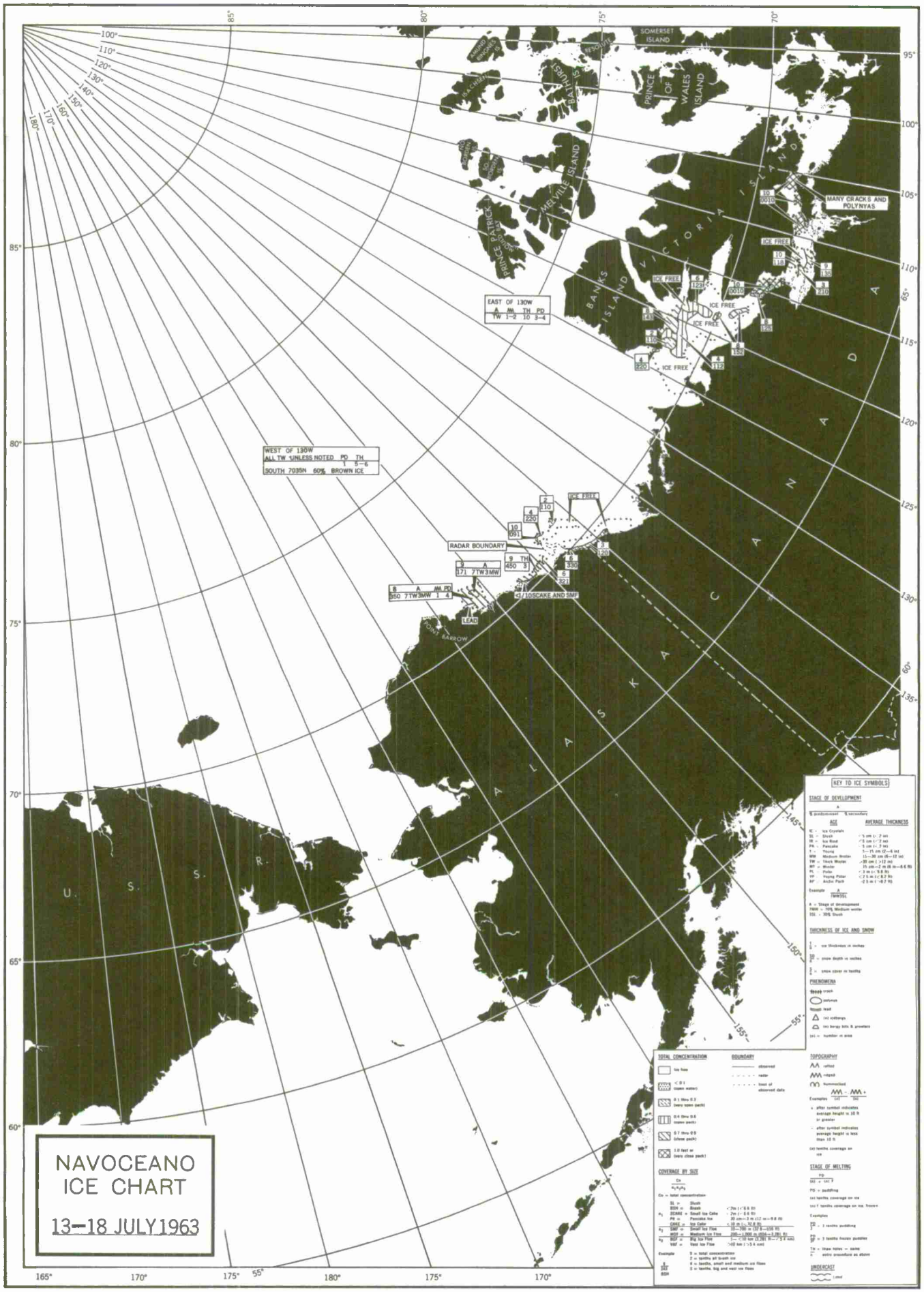

NAVOCEANO
ICE CHART
13-18 JUNE 1963
SOMERSET ISLAND
PRINCE OF WALES ISLAND
MELVILLE ISLAND
PRINCE PATRICK ISLAND
BANKS ISLAND
VICTORIA ISLAND
CANADA
ALASKA
U. S. S. R.
BARTER IS.
POINT BARROW
BELTS OF 5/230
CN 0.8
CN 0.6
ICE FREE
CN 0.3
CN 0.4
CN 0.7
10/10
RADAR PATCH EST CN 0.5
ALL
KEY TO ICE SYMBOLS
STAGE OF DEVELOPMENT
AGE
AVERAGE THICKNESS
TOTAL CONCENTRATION
BOUNDARY
TOPOGRAPHY
COVERAGE BY SIZE
STAGE OF MELTING
UNDERCAST


NAVOCEANO
ICE CHART
19-24 JUNE 1963
SOMERSET ISLAND
PRINCE OF WALES ISLAND
MELVILLE ISLAND
PRINCE PATRICK ISLAND
BANKS ISLAND
VICTORIA ISLAND
CANADA
ALASKA
U. S. S. R.
FAST ICE
BARTER IS.
POINT BARROW
2 MILE FLAW LEAD
CNO.5
RADAR BOUNDARY
ICE FREE
RADAR CNO.6 EST
CNO.6 ROTTEN
CNO.2
KEY TO ICE SYMBOLS
STAGE OF DEVELOPMENT
AGE
AVERAGE THICKNESS
TOTAL CONCENTRATION
BOUNDARY
TOPOGRAPHY
COVERAGE BY SIZE
STAGE OF MELTING
UNDERCAST

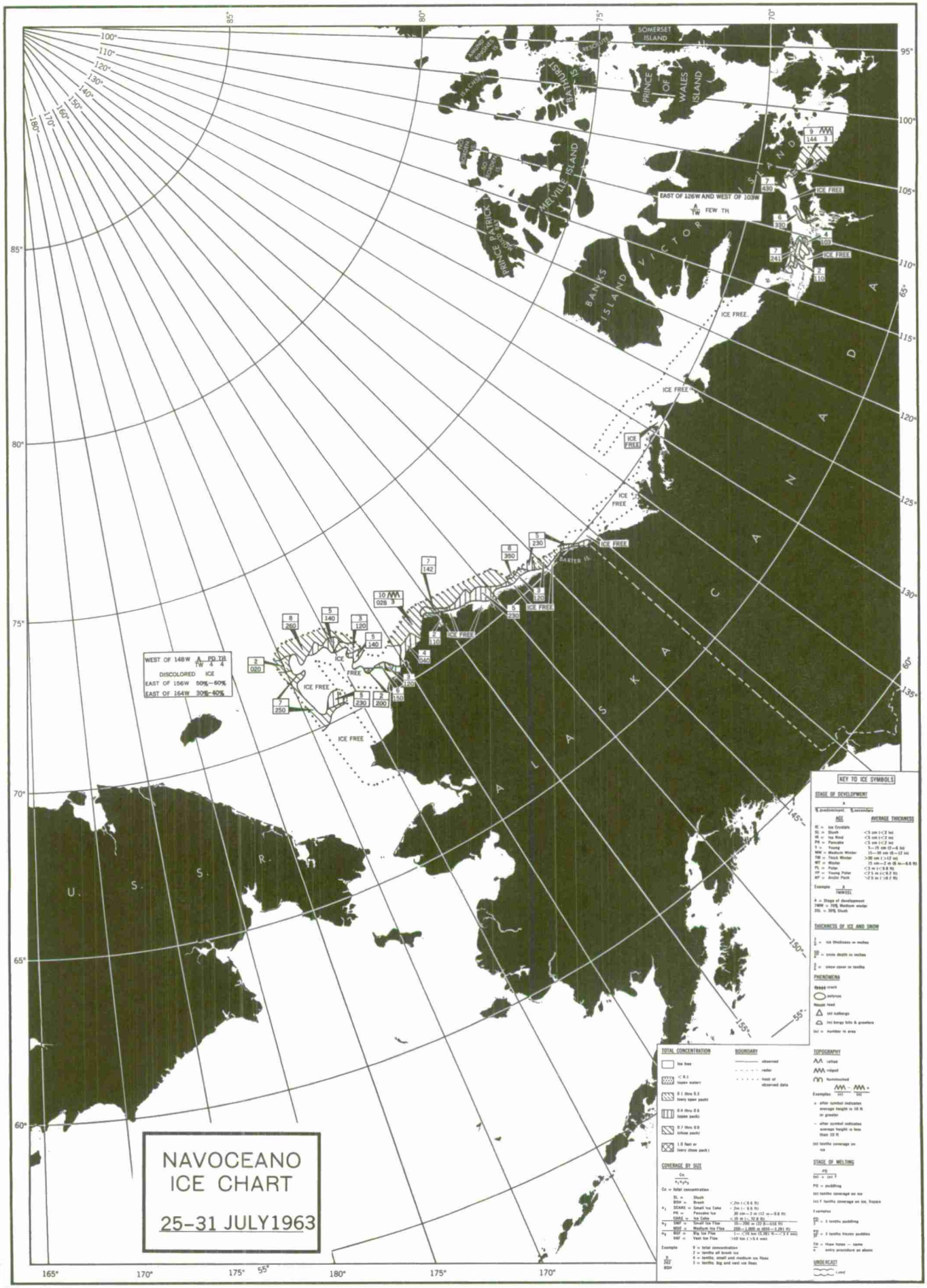

NAVOCEANO
ICE CHART
25-30 JUNE 1963
SOMERSET ISLAND
PRINCE OF WALES ISLAND
VICTORIA ISLAND
BANKS ISLAND
MELVILLE ISLAND
PRINCE PATRICK ISLAND
CANADA
ALASKA
U. S. S. R.
POINT BARROW
BARTER IS.
FAST ICE
RADAR LEADS
RADAR LEAD
ICE FREE
FEW DISCOLORED FLOES
KEY TO ICE SYMBOLS
STAGE OF DEVELOPMENT
AGE
AVERAGE THICKNESS
THICKNESS OF ICE AND SNOW
PHENOMENA
TOPOGRAPHY
STAGE OF MELTING
TOTAL CONCENTRATION
BOUNDARY
COVERAGE BY SIZE
UNDERCAST

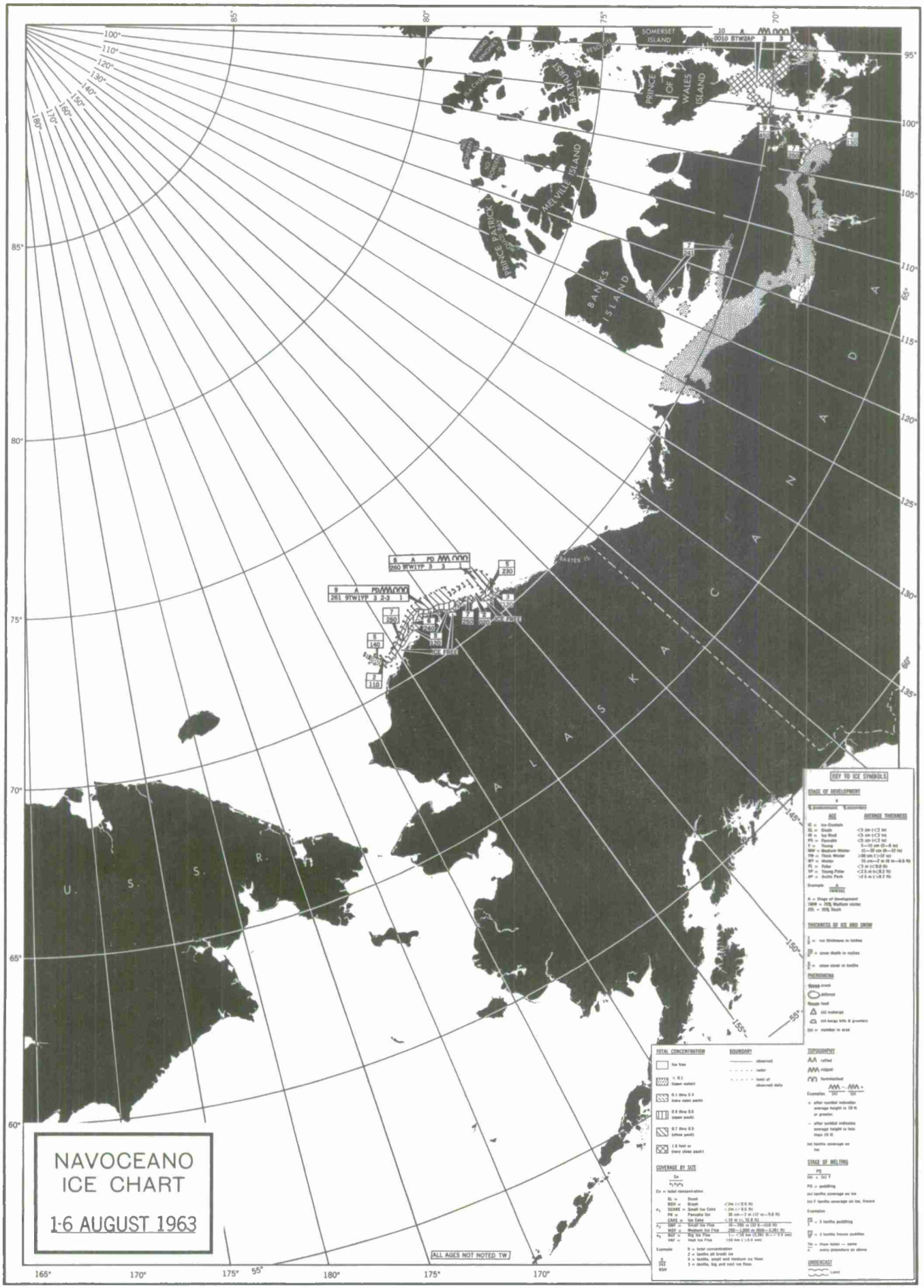

NAVOCEANO
ICE CHART
1-6 JULY 1963
SOMERSET ISLAND
PRINCE OF WALES ISLAND
MELVILLE ISLAND
VICTORIA ISLAND
BANKS ISLAND
PRINCE PATRICK ISLAND
CANADA
ALASKA
U. S. S. R.
POINT BARROW
BARTER IS.
ICE FREE
FAST ICE
KEY TO ICE SYMBOLS
STAGE OF DEVELOPMENT
AGE
AVERAGE THICKNESS
THICKNESS OF ICE AND SNOW
PHENOMENA
TOPOGRAPHY
TOTAL CONCENTRATION
BOUNDARY
COVERAGE BY SIZE
STAGE OF MELTING
UNDERCAST

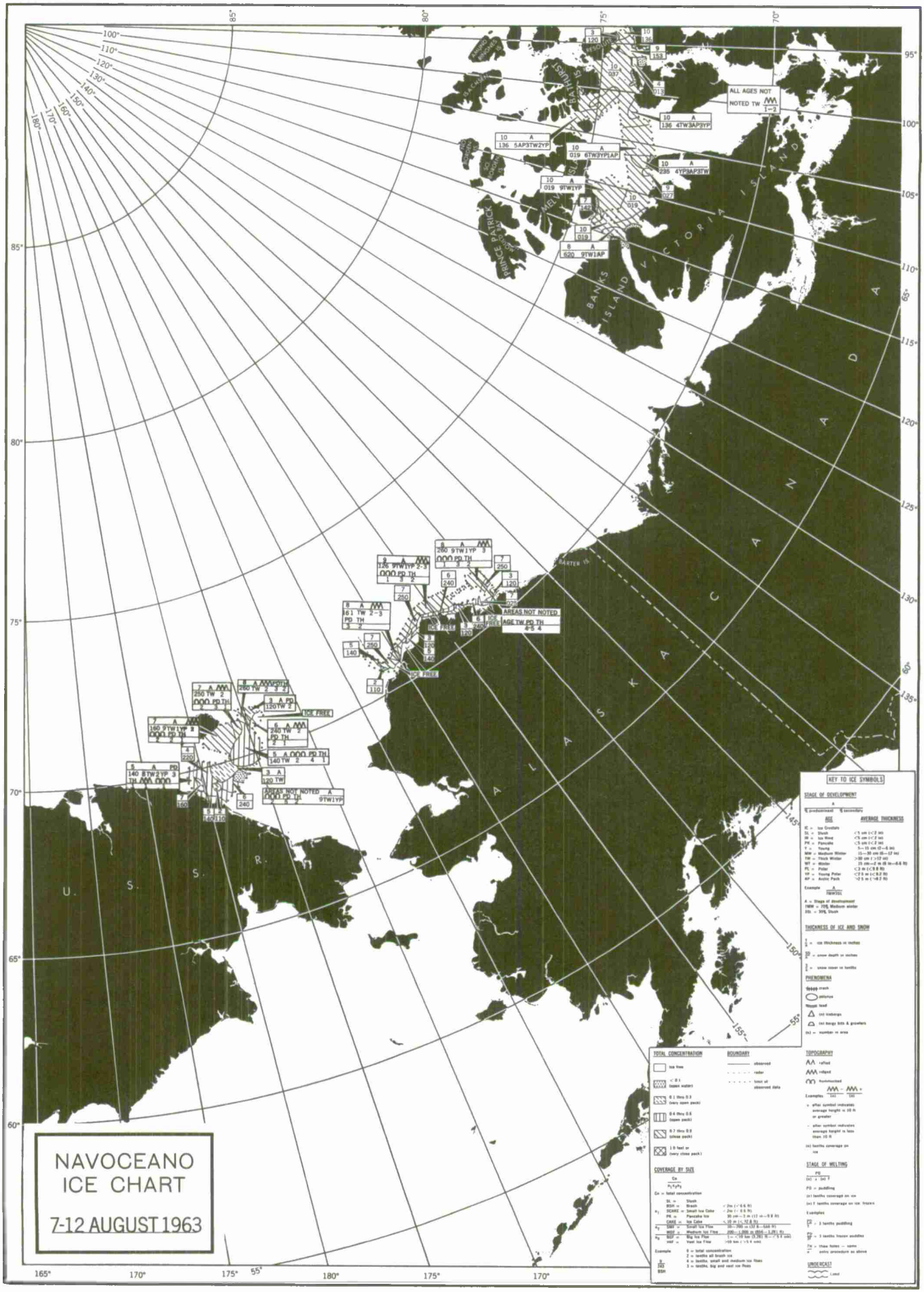

NAVOCEANO
ICE CHART
7–12 JULY 1963
SOMERSET ISLAND
PRINCE OF WALES ISLAND
MELVILLE ISLAND
PRINCE PATRICK
BANKS ISLAND
VICTORIA ISLAND
BATHURST
C A N A D A
A L A S K A
U. S. S. R.
POINT BARROW
ALL AREAS NOT NOTED
KEY TO ICE SYMBOLS
STAGE OF DEVELOPMENT
THICKNESS OF ICE AND SNOW
PHENOMENA
TOTAL CONCENTRATION
BOUNDARY
TOPOGRAPHY
COVERAGE BY SIZE
STAGE OF MELTING
UNDERCAST

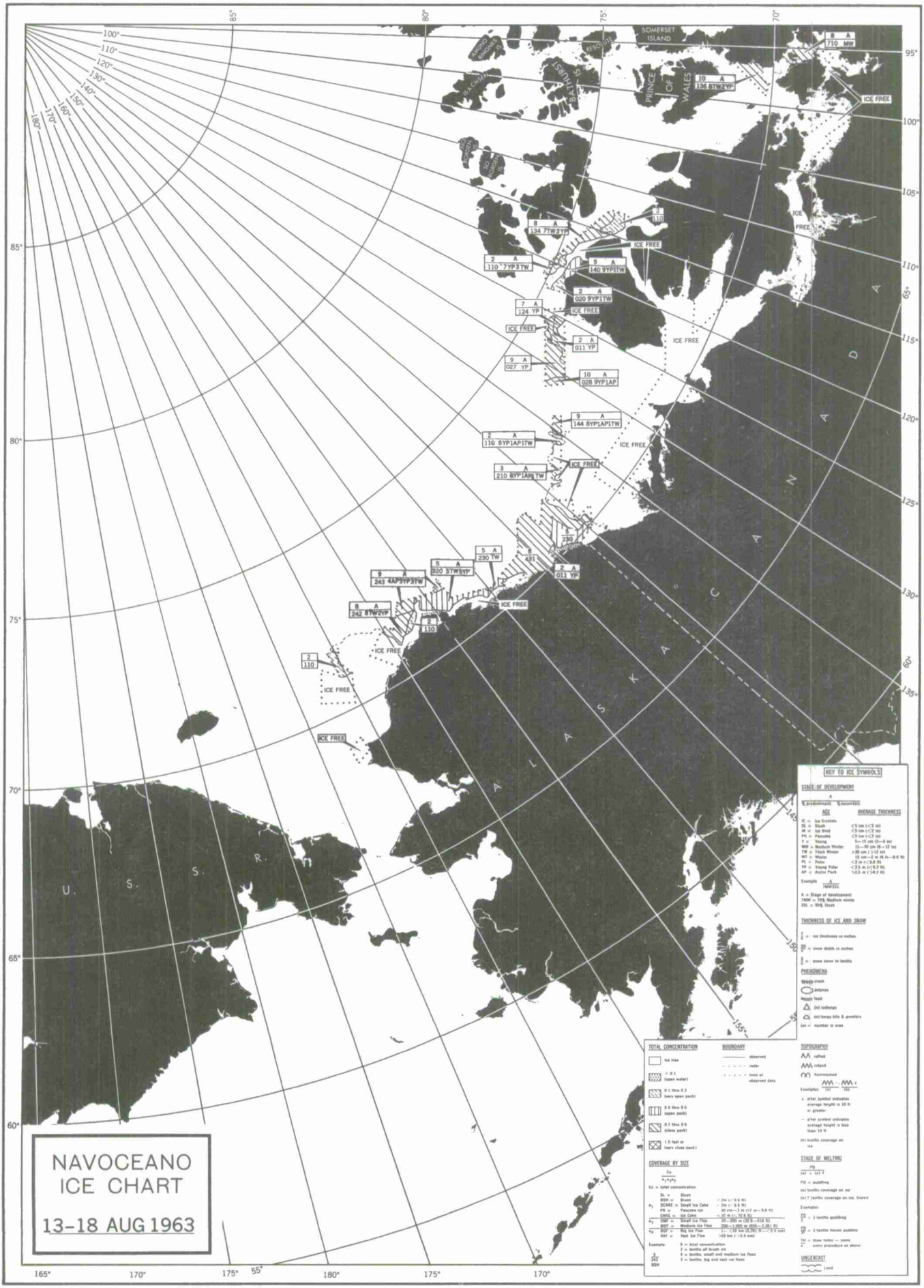

NAVOCEANO
ICE CHART
13–18 JULY 1963
SOMERSET ISLAND
PRINCE OF WALES ISLAND
MERVILLE ISLAND
PRINCE PATRICK ISLAND
BANKS ISLAND
VICTORIA ISLAND
CANADA
ALASKA
U. S. S. R.
MANY CRACKS AND POLYNYAS
ICE FREE
EAST OF 130W
A AM TH PD
TW 1–2 10 3–4
WEST OF 130W
ALL TW UNLESS NOTED PD TH
1 5–6
SOUTH 70?5N 60% BROWN ICE
RADAR BOUNDARY
9 TH
450 3
A
171 7TW3MW
8 A AM PD
350 7TW3MW 1 4
4/10SCAKE AND SMP
LEAD
POINT BARROW
KEY TO ICE SYMBOLS
STAGE OF DEVELOPMENT
AGE
AVERAGE THICKNESS
THICKNESS OF ICE AND SNOW
PHENOMENA
TOPOGRAPHY
STAGE OF MELTING
UNDERCAST
TOTAL CONCENTRATION
BOUNDARY
COVERAGE BY SIZE

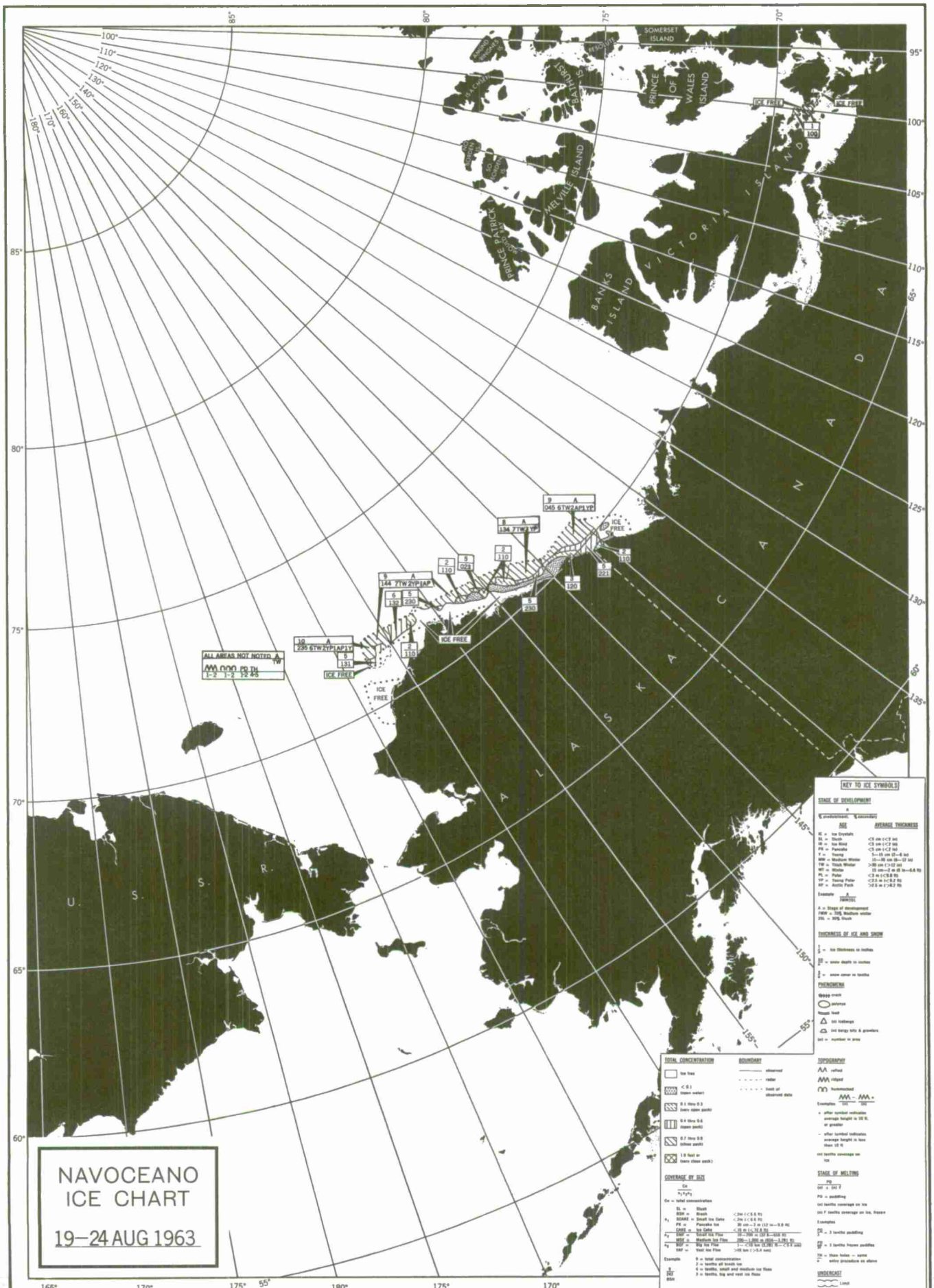

NAVOCEANO
ICE CHART
19–24 JULY 1963
SOMERSET ISLAND
PRINCE OF WALES ISLAND
MELVILLE ISLAND
PRINCE PATRICK ISLAND
BANKS ISLAND
VICTORIA ISLAND
CANADA
ALASKA
U. S. S. R.
RADAR BOUNDARY
ICE FREE
NOT NOTED BETWEEN 104W–123W
ALL AGE TW
KEY TO ICE SYMBOLS
STAGE OF DEVELOPMENT
AGE
AVERAGE THICKNESS
TOPOGRAPHY
STAGE OF MELTING
COVERAGE BY SIZE
BOUNDARY
TOTAL CONCENTRATION

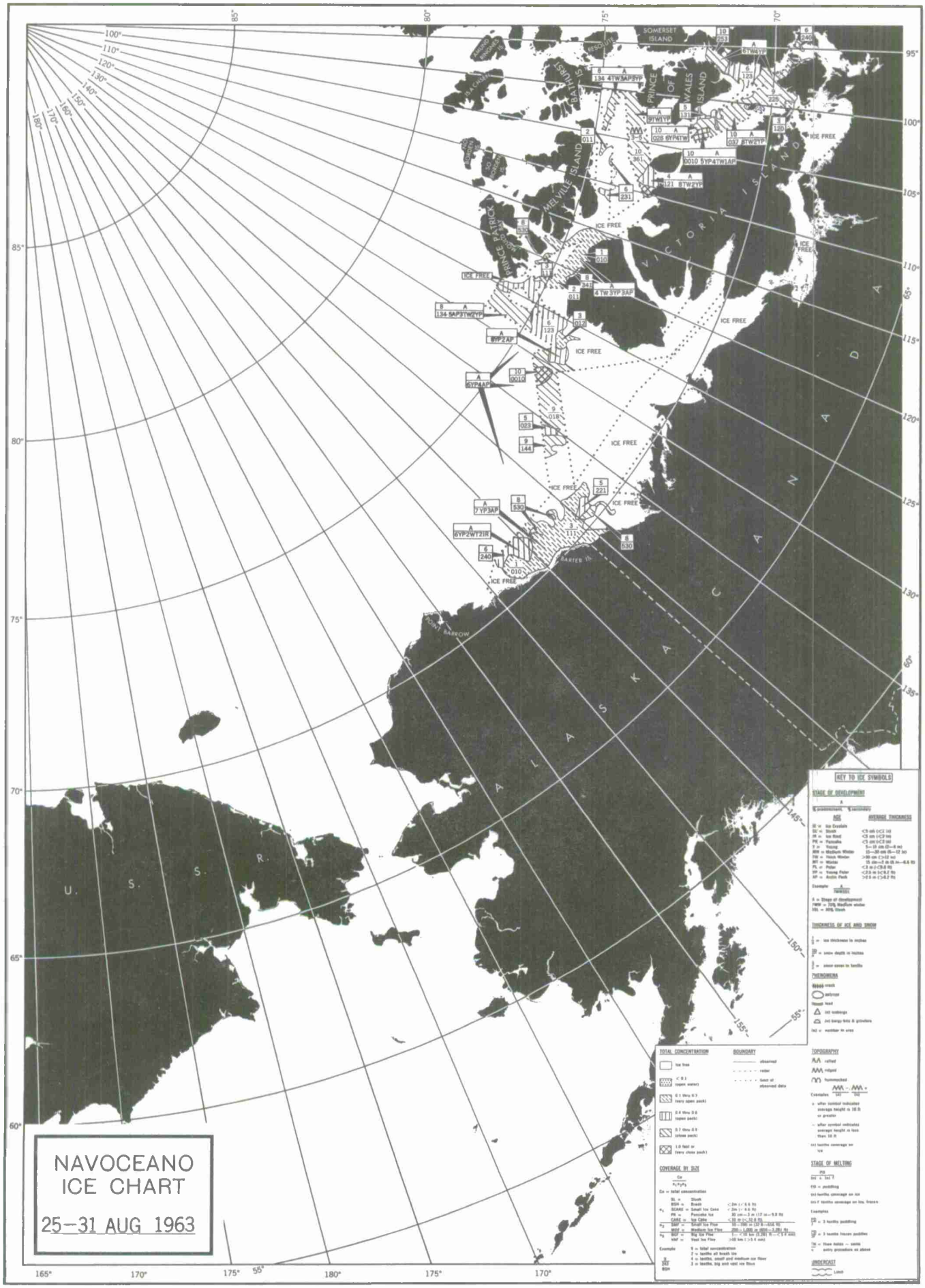

NAVOCEANO
ICE CHART
25-31 JULY1963
SOMERSET ISLAND
PRINCE OF WALES ISLAND
MELVILLE ISLAND
BANKS ISLAND
VICTORIA ISLAND
PRINCE PATRICK ISLAND
BARROW STRAIT
BATHURST ISLAND
BYAM MARTIN ISLAND
MELVILLE BAY
CANADA
ALASKA
U. S. S. R.
BARTER IS.
ICE FREE
EAST OF 126W AND WEST OF 103W
FEW TH
WEST OF 148W
DISCOLORED ICE
EAST OF 156W 50%–60%
EAST OF 164W 30%–40%
KEY TO ICE SYMBOLS
STAGE OF DEVELOPMENT
AGE
AVERAGE THICKNESS
THICKNESS OF ICE AND SNOW
PHENOMENA
TOTAL CONCENTRATION
BOUNDARY
TOPOGRAPHY
COVERAGE BY SIZE
STAGE OF MELTING
UNDERCAST

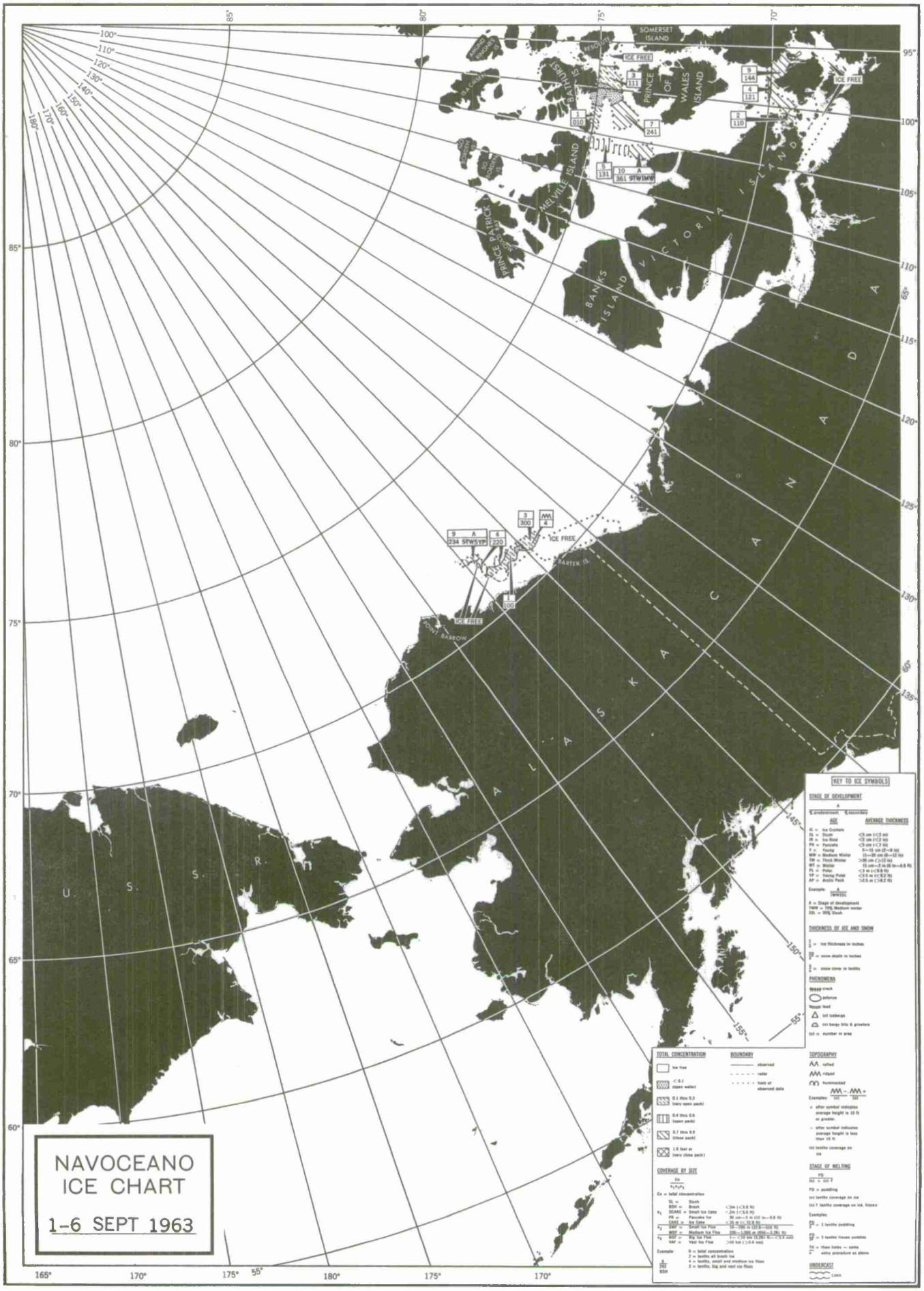

NAVOCEANO
ICE CHART
1-6 AUGUST 1963
SOMERSET ISLAND
PRINCE OF WALES ISLAND
MELVILLE ISLAND
PRINCE PATRICK ISLAND
BANKS ISLAND
BARTER IS.
ALASKA
CANADA
U. S. S. R.
ALL AGES NOT NOTED TW
KEY TO ICE SYMBOLS
STAGE OF DEVELOPMENT
AGE
AVERAGE THICKNESS
THICKNESS OF ICE AND SNOW
PHENOMENA
TOTAL CONCENTRATION
BOUNDARY
TOPOGRAPHY
COVERAGE BY SIZE
STAGE OF MELTING
UNDERCAST


NAVOCEANO
ICE CHART
7-12 AUGUST 1963
KEY TO ICE SYMBOLS
STAGE OF DEVELOPMENT
AGE
AVERAGE THICKNESS
THICKNESS OF ICE AND SNOW
PHENOMENA
TOTAL CONCENTRATION
BOUNDARY
TOPOGRAPHY
COVERAGE BY SIZE
STAGE OF MELTING
UNDERCAST
ALL AGES NOT NOTED TW 1–2
AREAS NOT NOTED
ICE FREE
BANKS ISLAND
VICTORIA ISLAND
PRINCE PATRICK ISLAND
MELVILLE ISLAND
CANADA
ALASKA
U. S. S. R.

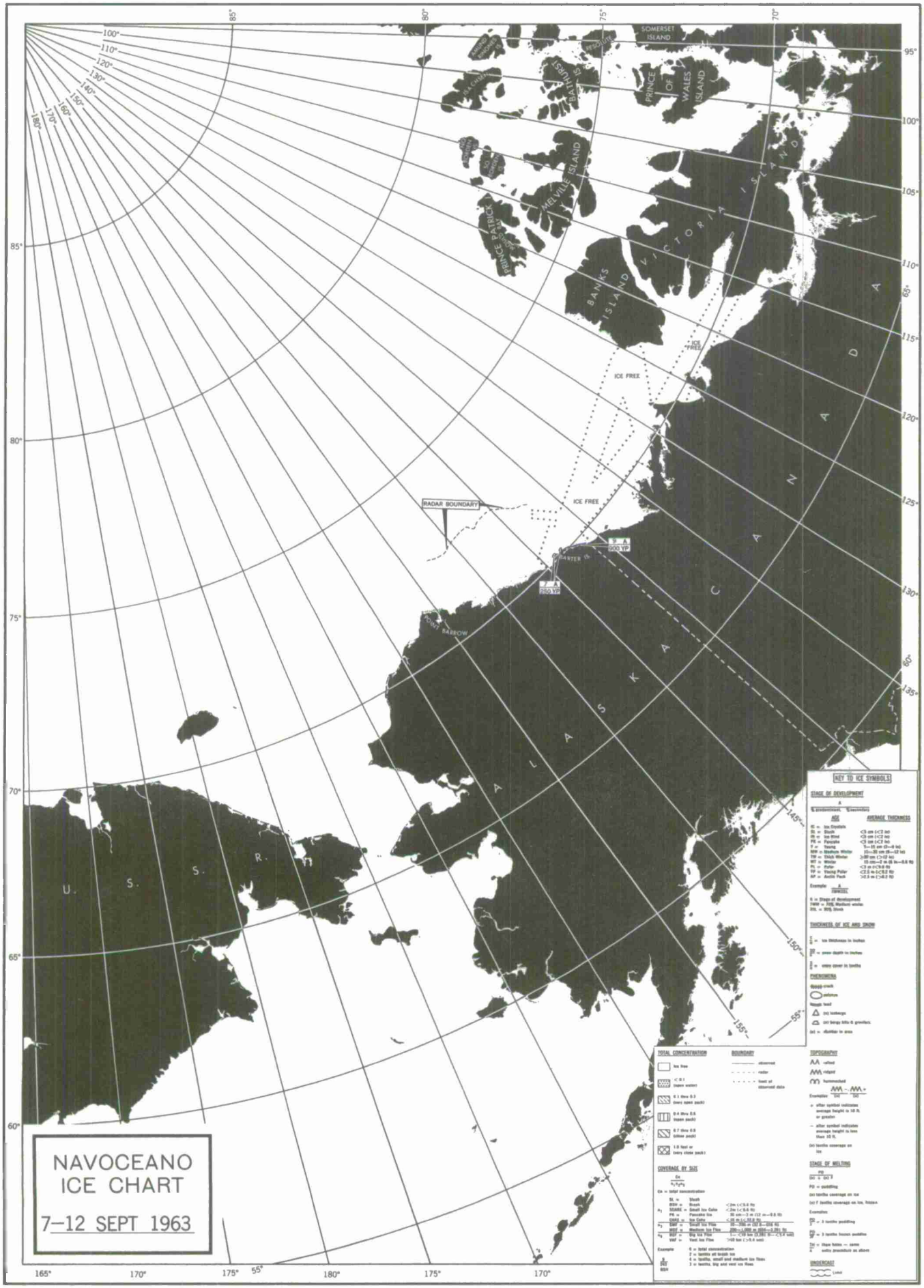

SOMERSET ISLAND
PRINCE OF WALES
ICE FREE
ICE
FREE
CANADA
ALASKA
U. S. S. R.
NAVOCEANO
ICE CHART
13-18 AUG 1963
KEY TO ICE SYMBOLS
STAGE OF DEVELOPMENT
AGE
AVERAGE THICKNESS
THICKNESS OF ICE AND SNOW
PHENOMENA
TOPOGRAPHY
TOTAL CONCENTRATION
BOUNDARY
COVERAGE BY SIZE
STAGE OF MELTING
UNDERCAST

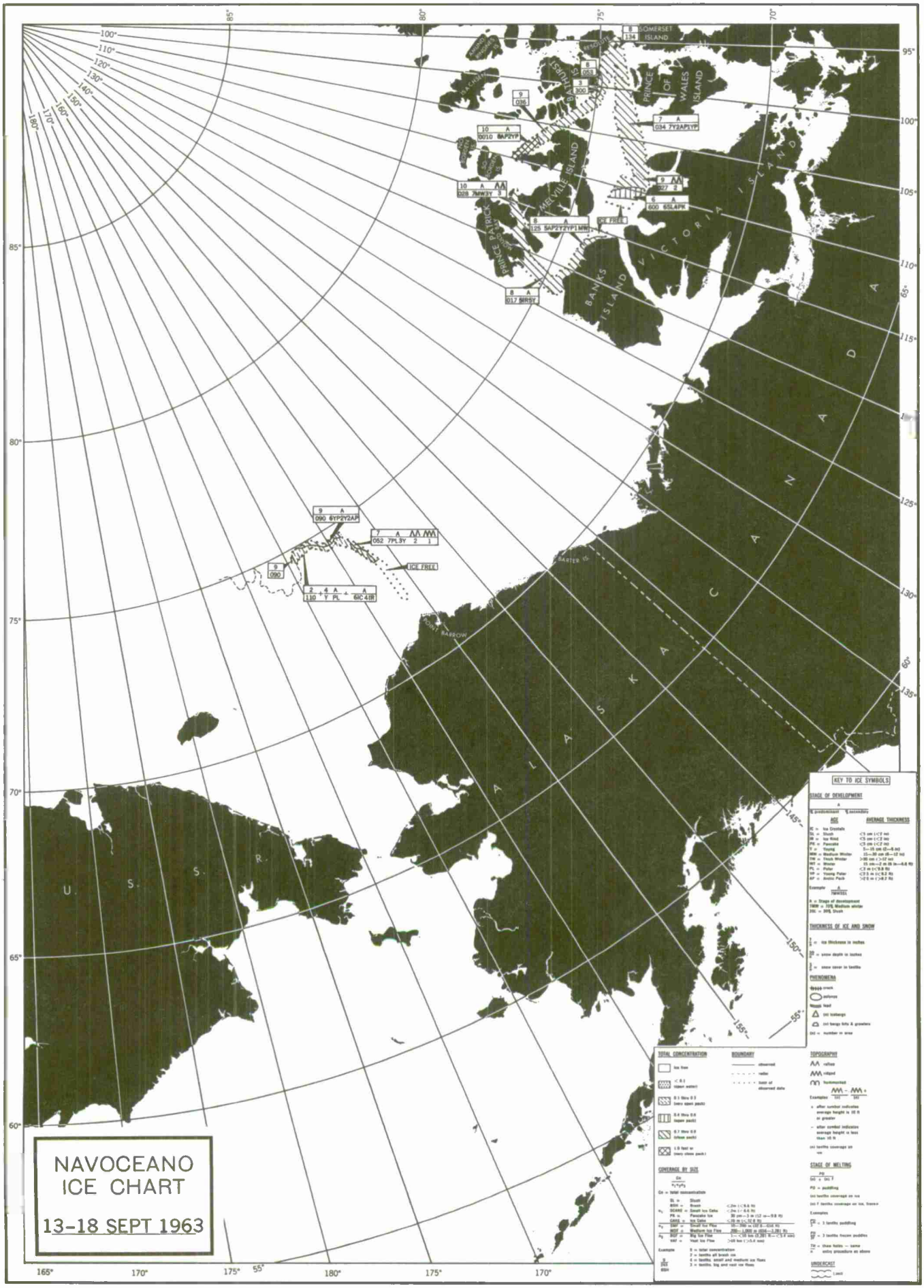

NAVOCEANO
ICE CHART
19–24 AUG 1963
SOMERSET ISLAND
PRINCE OF WALES ISLAND
MELVILLE ISLAND
BANKS ISLAND
VICTORIA ISLAND
CANADA
ALASKA
U. S. S. R.
ICE FREE
ALL AREAS NOT NOTED
KEY TO ICE SYMBOLS
STAGE OF DEVELOPMENT
AGE
AVERAGE THICKNESS
TOTAL CONCENTRATION
BOUNDARY
TOPOGRAPHY
COVERAGE BY SIZE
STAGE OF MELTING
UNDERCAST

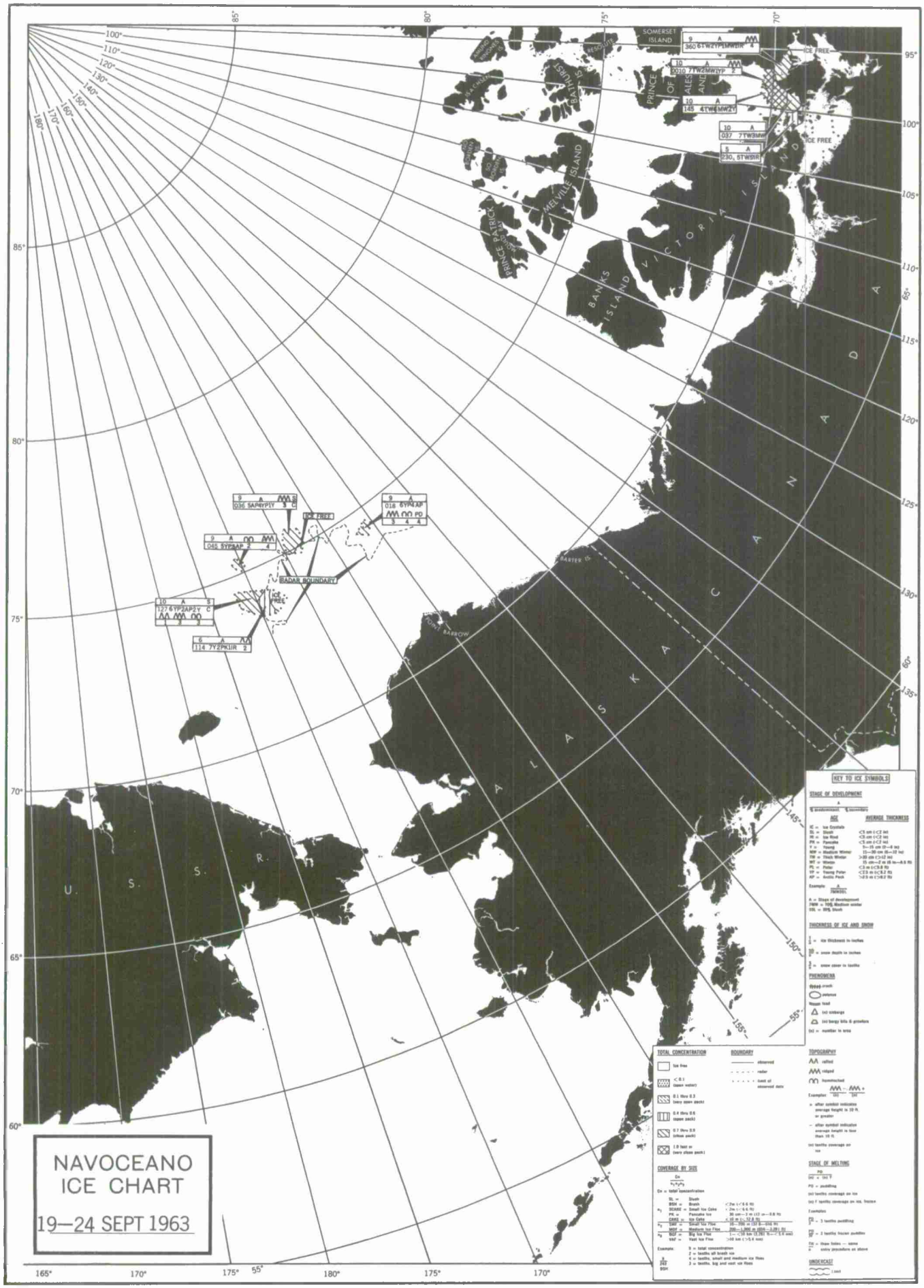

NAVOCEANO
ICE CHART
25–31 AUG 1963
KEY TO ICE SYMBOLS
STAGE OF DEVELOPMENT
AGE
AVERAGE THICKNESS
THICKNESS OF ICE AND SNOW
PHENOMENA
TOTAL CONCENTRATION
BOUNDARY
TOPOGRAPHY
COVERAGE BY SIZE
STAGE OF MELTING
UNDERCAST
SOMERSET ISLAND
PRINCE OF WALES ISLAND
MELVILLE ISLAND
VICTORIA ISLAND
PRINCE PATRICK ISLAND
BANKS ISLAND
ELLESMERE ISLAND
BARTER IS.
POINT BARROW
ICE FREE
CANADA
ALASKA
U. S. S. R.

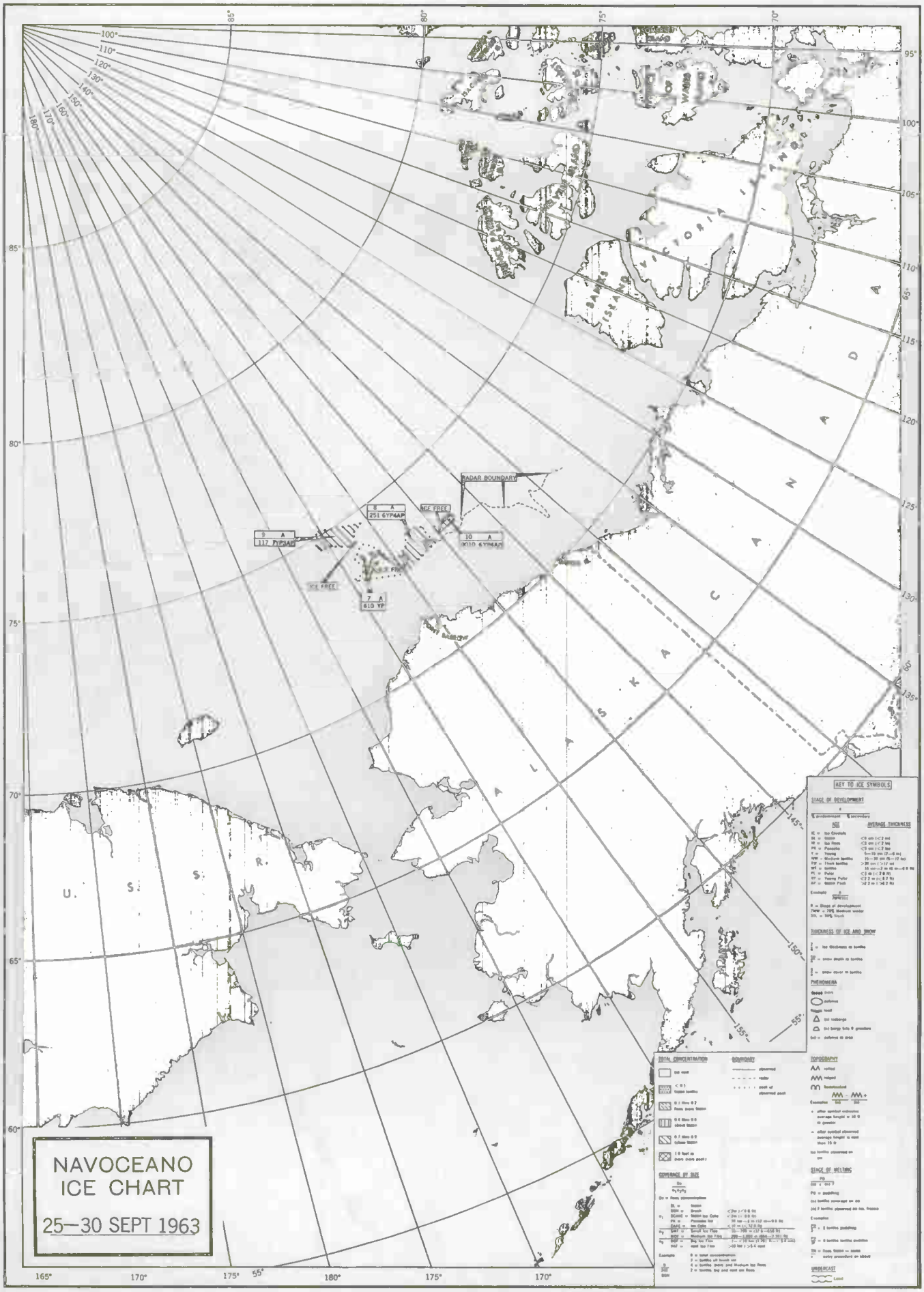

NAVOCEANO
ICE CHART
1-6 SEPT 1963
SOMERSET ISLAND
PRINCE OF WALES ISLAND
VICTORIA ISLAND
MELVILLE ISLAND
PRINCE PATRICK ISLAND
BANKS ISLAND
BARTER IS.
POINT BARROW
ICE FREE
CANADA
ALASKA
U. S. S. R.
KEY TO ICE SYMBOLS
STAGE OF DEVELOPMENT
AGE
AVERAGE THICKNESS
THICKNESS OF ICE AND SNOW
PHENOMENA
TOPOGRAPHY
STAGE OF MELTING
UNDERCAST
TOTAL CONCENTRATION
BOUNDARY
COVERAGE BY SIZE

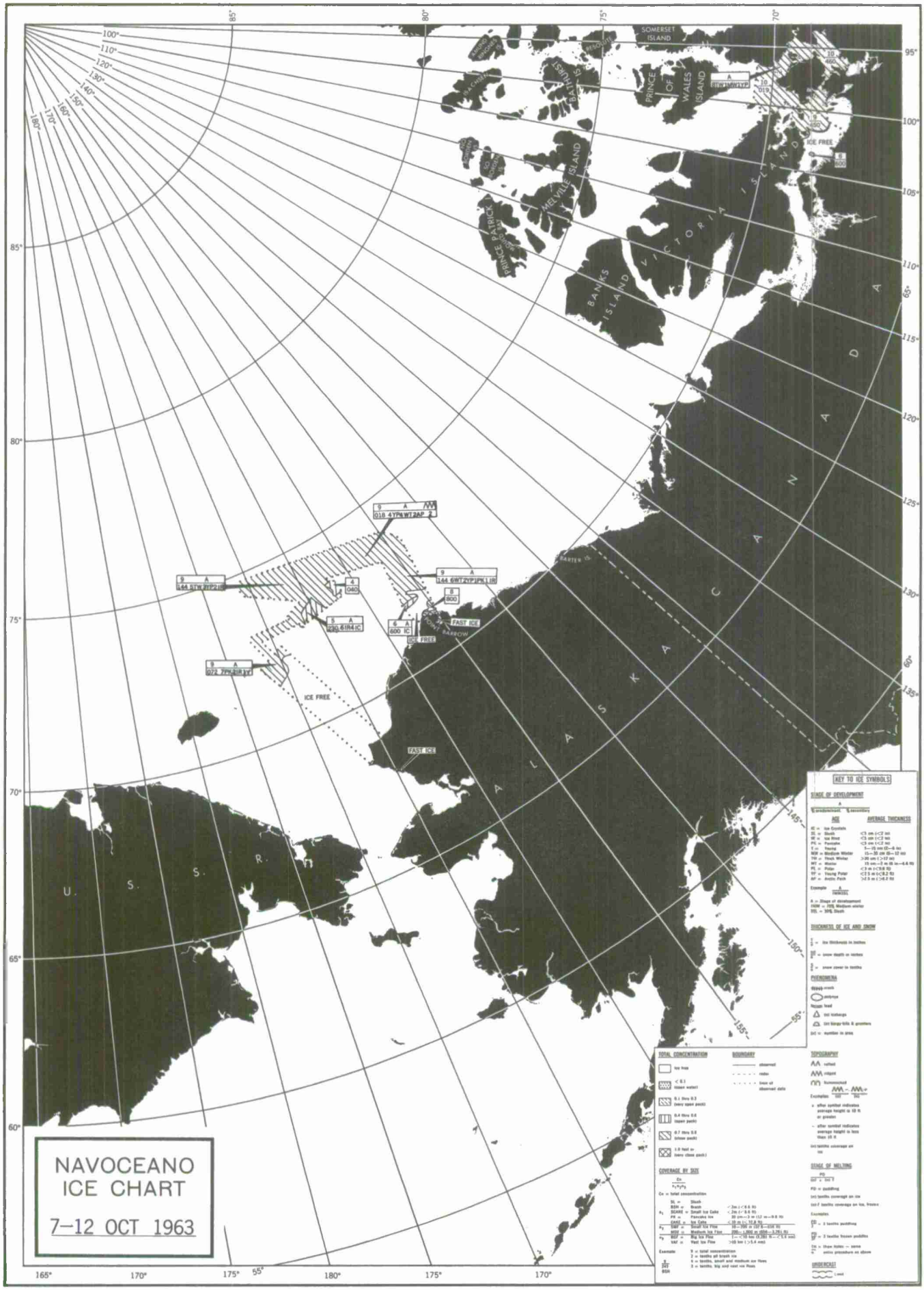
176

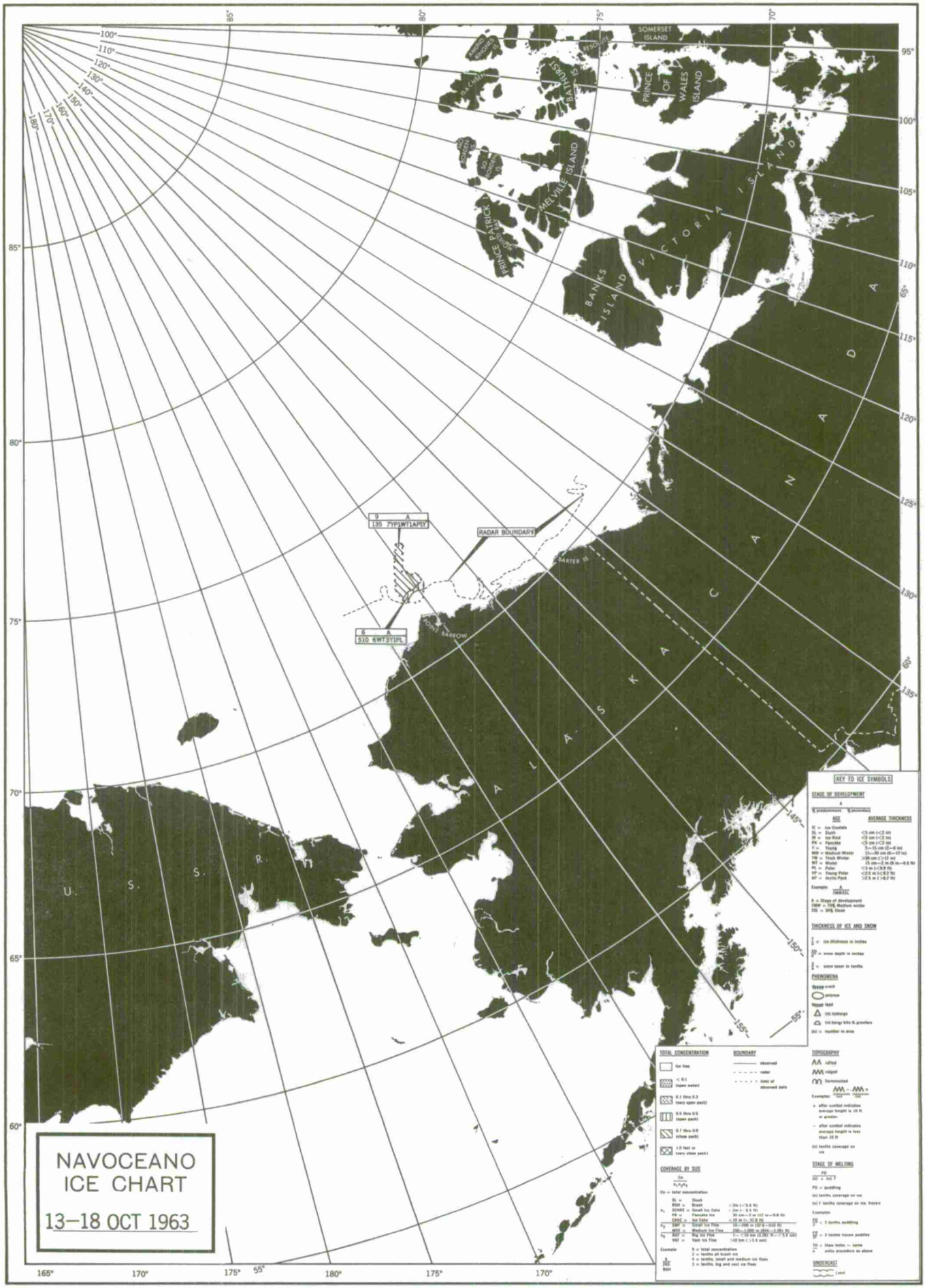

NAVOCEANO
ICE CHART
7–12 SEPT 1963
SOMERSET ISLAND
PRINCE OF WALES ISLAND
VICTORIA ISLAND
BANKS ISLAND
MELVILLE ISLAND
PRINCE PATRICK ISLAND
AMUNDSEN GULF
M'CLURE STRAIT
BAFFIN BAY
CANADA
ALASKA
U. S. S. R.
ICE FREE
RADAR BOUNDARY
BARTER I.
POINT BARROW
KEY TO ICE SYMBOLS
STAGE OF DEVELOPMENT
AGE
AVERAGE THICKNESS
TOTAL CONCENTRATION
BOUNDARY
TOPOGRAPHY
COVERAGE BY SIZE
STAGE OF MELTING
UNDERCAST

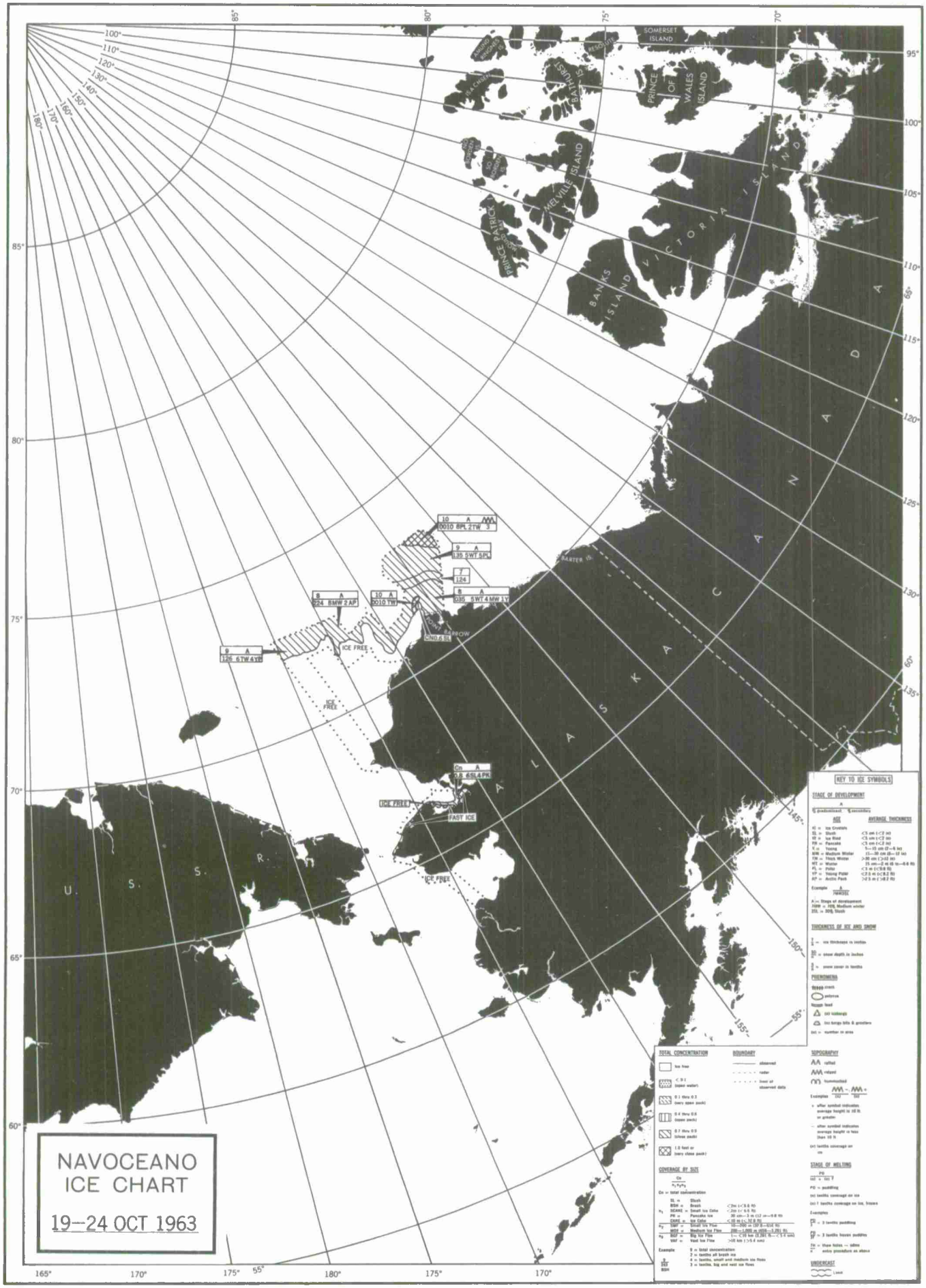

NAVOCEANO
ICE CHART
13-18 SEPT 1963
KEY TO ICE SYMBOLS
STAGE OF DEVELOPMENT
AGE
AVERAGE THICKNESS
THICKNESS OF ICE AND SNOW
PHENOMENA
TOTAL CONCENTRATION
BOUNDARY
TOPOGRAPHY
COVERAGE BY SIZE
STAGE OF MELTING
UNDERCAST
SOMERSET ISLAND
PRINCE OF WALES ISLAND
MELVILLE ISLAND
PRINCE PATRICK ISLAND
BANKS ISLAND
VICTORIA ISLAND
CANADA
ALASKA
U. S. S. R.
BARTER IS.
POINT BARROW
ICE FREE
ICE FREE

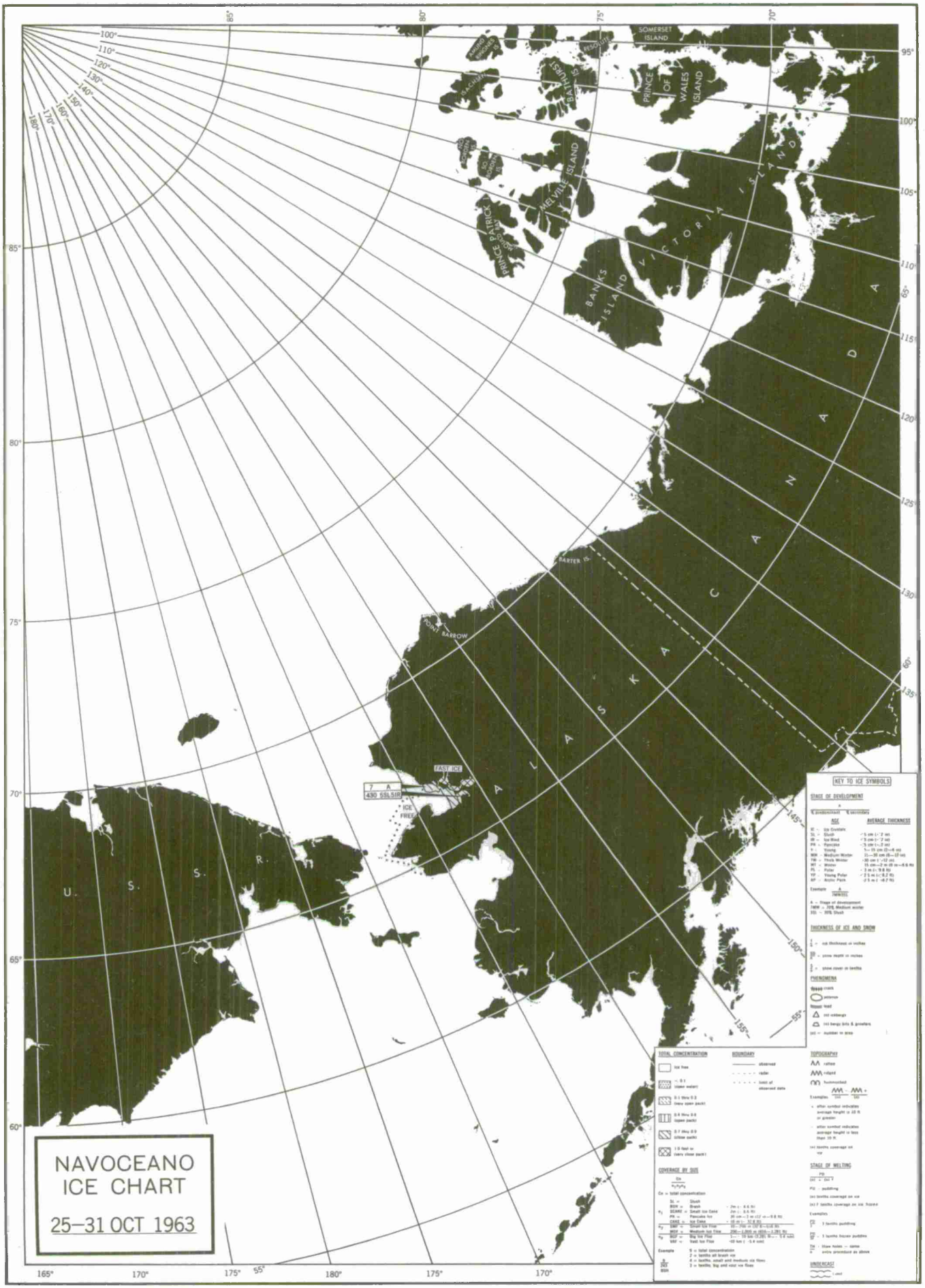

NAVOCEANO
ICE CHART
19—24 SEPT 1963
SOMERSET ISLAND
PRINCE OF WALES ISLAND
BATHURST ISLAND
MELVILLE ISLAND
PRINCE PATRICK ISLAND
BANKS ISLAND
VICTORIA ISLAND
ICE FREE
RADAR BOUNDARY
POINT BARROW
BARTER IS.
A L A S K A
C A N A D A
U. S. S. R.
KEY TO ICE SYMBOLS
STAGE OF DEVELOPMENT
AGE
AVERAGE THICKNESS
TOTAL CONCENTRATION
BOUNDARY
TOPOGRAPHY
COVERAGE BY SIZE
STAGE OF MELTING
UNDERCAST

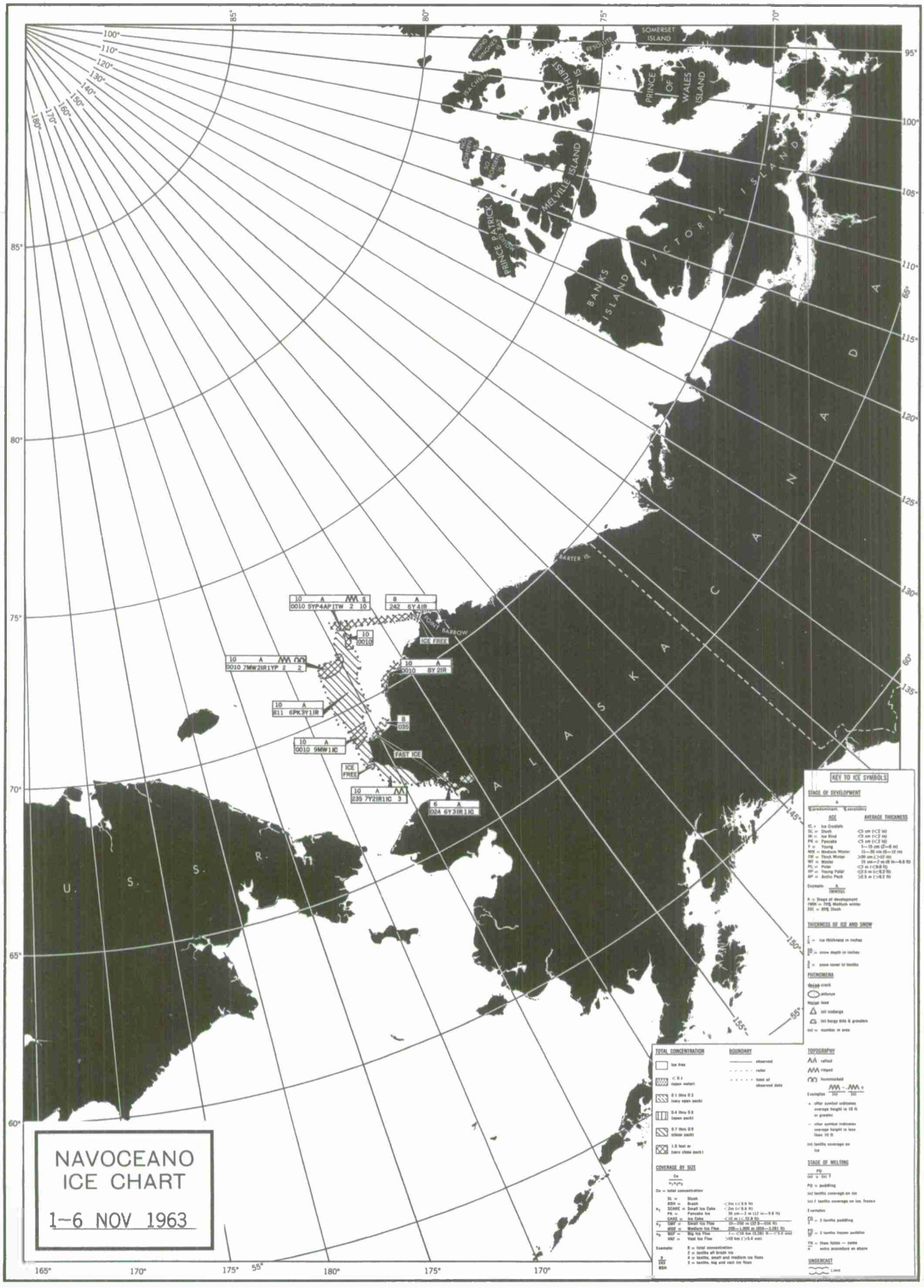

NAVOCEANO
ICE CHART
25—30 SEPT 1963
RADAR BOUNDARY
ICE FREE
ICE FREE
KEY TO ICE SYMBOLS
STAGE OF DEVELOPMENT
AVERAGE THICKNESS
THICKNESS OF ICE AND SNOW
PHENOMENA
TOTAL CONCENTRATION
BOUNDARY
TOPOGRAPHY
STAGE OF MELTING
UNDERCAST
U. S. S. R.
A L A S K A
C A N A D A
VICTORIA ISLAND
BANKS ISLAND


NAVOCEANO
ICE CHART
7–12 OCT 1963
SOMERSET ISLAND
PRINCE OF WALES ISLAND
MELVILLE ISLAND
PRINCE PATRICK ISLAND
BANKS ISLAND
VICTORIA ISLAND
CANADA
ALASKA
U. S. S. R.
BARTER IS.
POINT BARROW
FAST ICE
ICE FREE
KEY TO ICE SYMBOLS
STAGE OF DEVELOPMENT
AGE
AVERAGE THICKNESS
THICKNESS OF ICE AND SNOW
PHENOMENA
TOPOGRAPHY
STAGE OF MELTING
TOTAL CONCENTRATION
BOUNDARY
COVERAGE BY SIZE
UNDERCAST

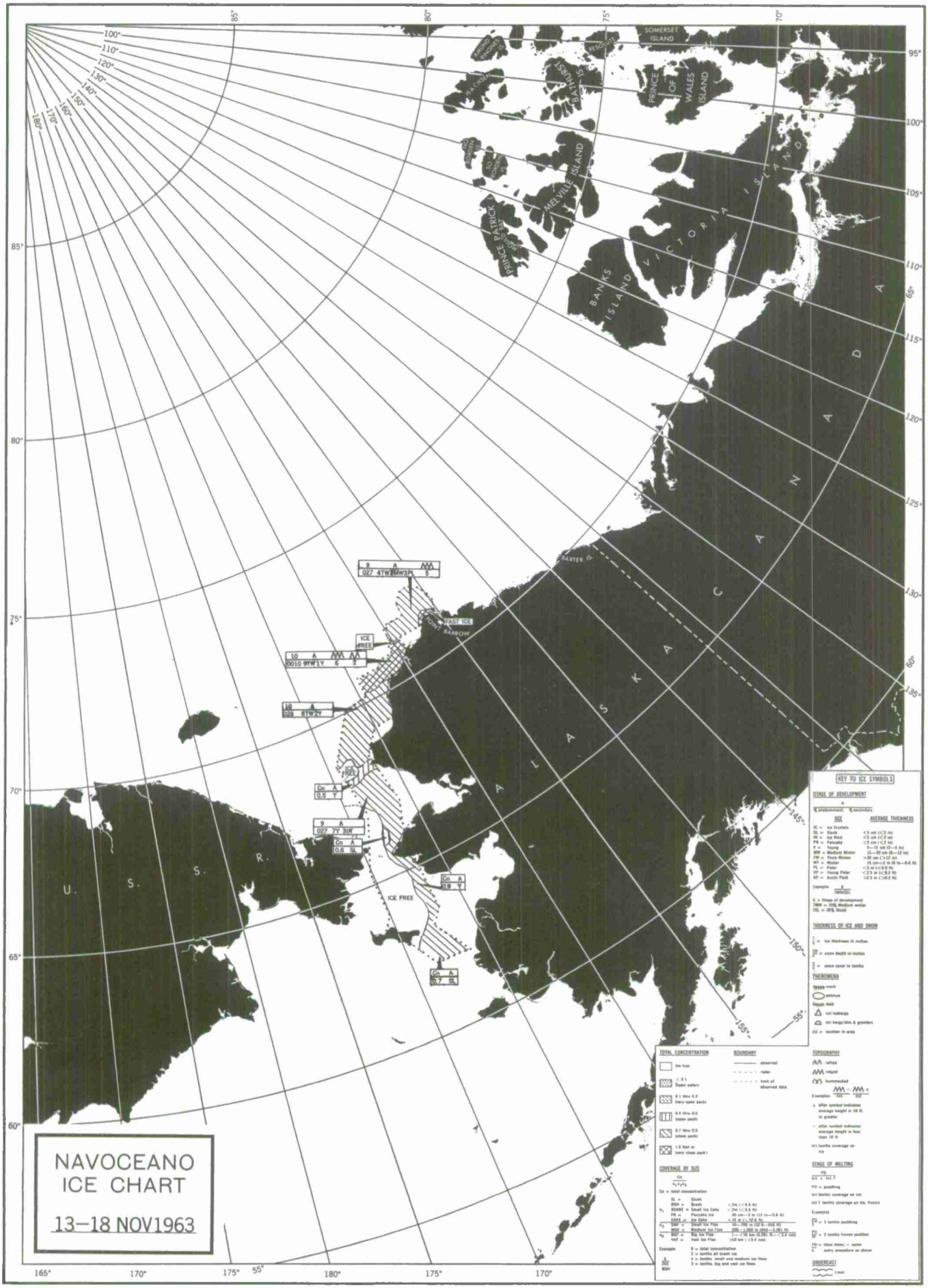

NAVOCEANO
ICE CHART
13–18 OCT 1963
SOMERSET ISLAND
PRINCE OF WALES ISLAND
MELVILLE ISLAND
VICTORIA ISLAND
BANKS ISLAND
PRINCE PATRICK ISLAND
CANADA
ALASKA
U.S.S.R.
RADAR BOUNDARY
BARTER IS
POINT BARROW
9 A
135 7YP1WT1APLY
S A
510 6WT3YIPL
KEY TO ICE SYMBOLS
STAGE OF DEVELOPMENT
TOTAL CONCENTRATION
BOUNDARY
TOPOGRAPHY
COVERAGE BY SIZE
STAGE OF MELTING
UNDERCAST

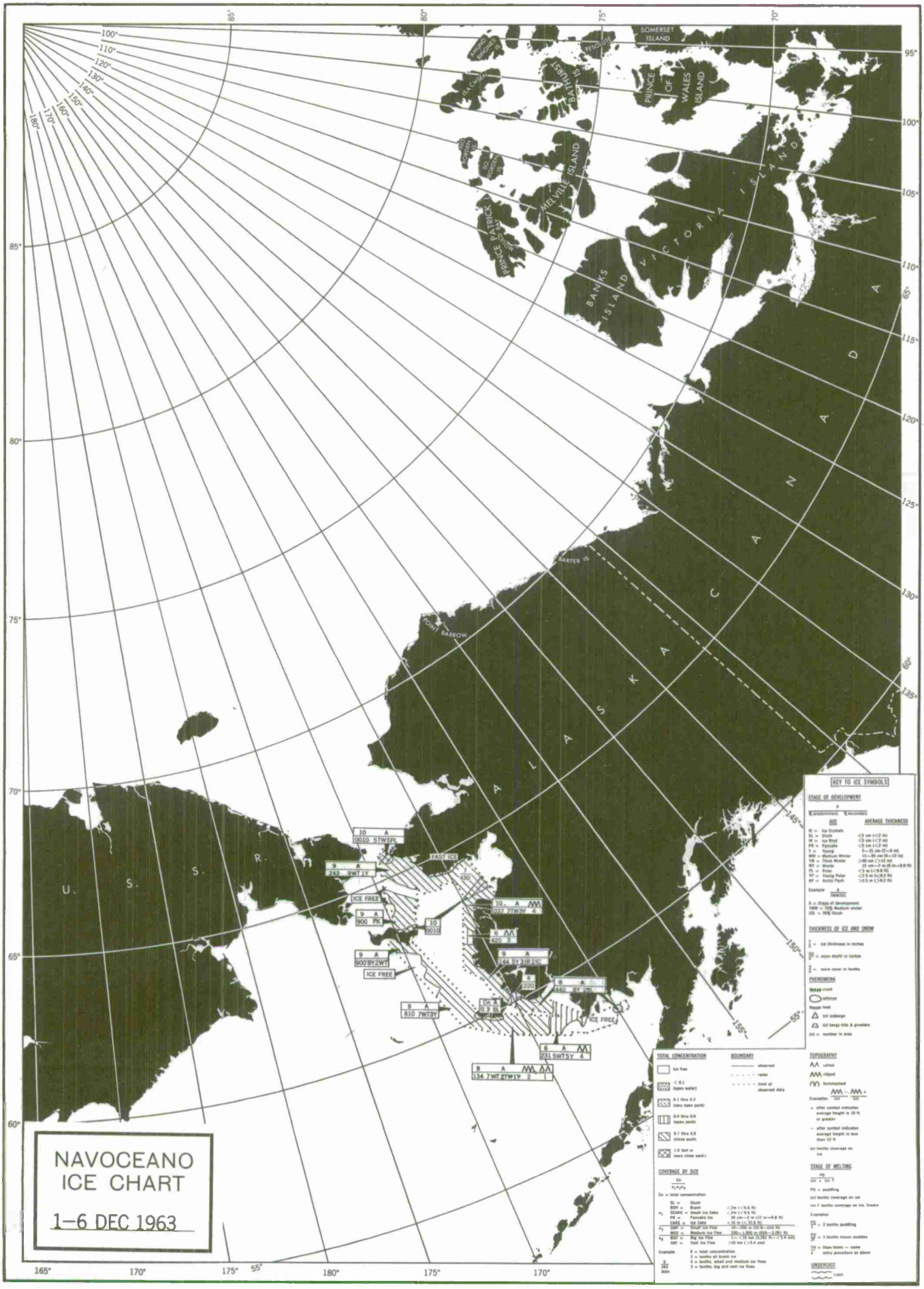

NAVOCEANO
ICE CHART
19--24 OCT 1963
SOMERSET ISLAND
PRINCE OF WALES ISLAND
MELVILLE ISLAND
PRINCE PATRICK ISLAND
BANKS ISLAND
VICTORIA ISLAND
CANADA
ALASKA
U. S. S. R.
BARTER IS.
ICE FREE
FAST ICE
KEY TO ICE SYMBOLS
STAGE OF DEVELOPMENT
AGE
AVERAGE THICKNESS
TOTAL CONCENTRATION
BOUNDARY
TOPOGRAPHY
COVERAGE BY SIZE
STAGE OF MELTING
UNDERCAST


NAVOCEANO
ICE CHART
25–31 OCT 1963
SOMERSET ISLAND
PRINCE OF WALES ISLAND
BANKS ISLAND
VICTORIA ISLAND
MELVILLE ISLAND
PRINCE PATRICK ISLAND
CANADA
ALASKA
U. S. S. R.
BARROW
POINT BARROW
BARTER IS.
FAST ICE
ICE FREE
7 A
430 SSL 5IR
KEY TO ICE SYMBOLS
STAGE OF DEVELOPMENT
AGE
AVERAGE THICKNESS
THICKNESS OF ICE AND SNOW
PHENOMENA
TOTAL CONCENTRATION
BOUNDARY
TOPOGRAPHY
COVERAGE BY SIZE
STAGE OF MELTING
UNDERCAST


NAVOCEANO
ICE CHART
1-6 NOV 1963
SOMERSET ISLAND
PRINCE OF WALES ISLAND
MELVILLE ISLAND
PRINCE PATRICK ISLAND
BANKS ISLAND
VICTORIA ISLAND
CANADA
ALASKA
U.S.S.R.
BARROW
BARTER IS.
ICE FREE
FAST ICE
10 A 8
0010 SYP4AP1TW 2 10
8 A
242 6Y4IR
10
0010
10 A
0010 7MW2IR1YP 2 2
10 A
0010 8Y2IR
10 A
811 6PK3Y1IR
8
030
10 A
0010 9MW1IC
ICE FREE
10 A
235 7Y2IR1IC 3
6 A
024 6Y3IR1IC
KEY TO ICE SYMBOLS
STAGE OF DEVELOPMENT
AGE
AVERAGE THICKNESS
THICKNESS OF ICE AND SNOW
PHENOMENA
TOPOGRAPHY
TOTAL CONCENTRATION
BOUNDARY
COVERAGE BY SIZE
STAGE OF MELTING
UNDERCAST


NAVOCEANO
ICE CHART
7–12 NOV 1963
SOMERSET ISLAND
PRINCE OF WALES ISLAND
MELVILLE ISLAND
BANKS ISLAND
VICTORIA ISLAND
CANADA
ALASKA
U.S.S.R.
POINT BARROW
KEY TO ICE SYMBOLS
STAGE OF DEVELOPMENT
AGE
AVERAGE THICKNESS
THICKNESS OF ICE AND SNOW
PHENOMENA
TOPOGRAPHY
STAGE OF MELTING
TOTAL CONCENTRATION
BOUNDARY
COVERAGE BY SIZE
UNDERCAST


NAVOCEANO
ICE CHART
13–18 NOV1963
SOMERSET ISLAND
PRINCE OF WALES ISLAND
MELVILLE ISLAND
VICTORIA ISLAND
BANKS ISLAND
CANADA
ALASKA
U. S. S. R.
BARTER IS.
POINT BARROW
FAST ICE
ICE FREE
ICE FREE
ICE FREE
KEY TO ICE SYMBOLS
STAGE OF DEVELOPMENT
AGE
AVERAGE THICKNESS
THICKNESS OF ICE AND SNOW
PHENOMENA
TOTAL CONCENTRATION
BOUNDARY
TOPOGRAPHY
COVERAGE BY SIZE
STAGE OF MELTING
UNDERCAST


NAVOCEANO
ICE CHART
1–6 DEC 1963
SOMERSET ISLAND
PRINCE OF WALES ISLAND
MELVILLE ISLAND
PRINCE PATRICK ISLAND
BANKS ISLAND
VICTORIA ISLAND
CANADA
ALASKA
U. S. S. R.
POINT BARROW
BARTER IS.
FAST ICE
ICE FREE
KEY TO ICE SYMBOLS
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AVERAGE THICKNESS
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STAGE OF MELTING
UNDERCAST

U.S. Naval Oceanographic Office.
REPORT OF THE ICE OBSERVING AND FORECASTING PROGRAM, 1963, by Oceanographic Prediction Division, May 1965. 188 pages, including 177 figures and 1 table. (SP-70(63))

A summary of NAVOCEANO and Danish ice operations during 1963 is presented. Operational aspects of obtaining and disseminating ice information and the ice forecasting and observing program are discussed. Ice charts depict observed synoptic ice conditions throughout the year. Locations of oceanographic stations occupied in the polar and subpolar regions are included.

1. Ice distribution - Arctic
2. Ice forecasting - Arctic
3. Oceanography - Arctic
i. title: Report of the ice observing and forecasting program, 1963
ii. SP-70(63)

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